The Dock and Harbour Authority

No. 221. Vol. XIX. Edited by BRYSSON CUNNINGHAM, D.Sc., B.E., F.R.S.E., M.Inst.C.E. MARCH, 1939

Editorial Comments

A Canadian All-Year-Round Port.

On the north side of the Bay of Fundy and on the southern coastline of the Province of New Brunswick, lies the Port of St. John, which this month is the subject of our leading article and special Supplement. The port is characterised, not only by the capaciousness and depth of its harbour, which is excellently sheltered within the estuary of the St. John River, but also by the fact that it is accessible to shipping throughout the year in contradistinction to certain other Eastern Canadian ports, which for several months every winter are more or less icebound and closed to navigation.

St. John is situated on a rocky peninsula on the North bank of the Estuary, which attains five miles in width, and is remarkable for its "Reversing Falls," as they are termed, occasioned by the alternate inward and outward flow of the exceptionally high tides associated with the Bay of Fundy.

The capital of its county, but not, despite its size and importance, the capital of the Province, St. John is 277 miles by rail N.W. of Halifax, Nova Scotia, its chief competitive port in Canadian territory, and 481 miles from Montreal, which it supersedes during the winter season as an exporting port for the grain of the Canadian West.

The history of the place is not particularly romantic. It was first visited by Europeans in 1604, and received a band of French settlers in 1635, who passed under the British flag early in the eigtheenth century.

In 1783, there was an influx of ten thousand United Empire Loyalists, and the city thereupon assumed a considerable degree of importance. It received a Charter of incorporation in 1835, one of the oldest in Canada. Fire ravaged it in the late seventies, but it recovered and absorbed the neighbouring town of Portland in 1889. To-day it has a population of something like 50,000.

As regards trade, port returns show that 4,335 ships, aggregating 4,991,848 tons, called last year, in comparison with 4,177 ships of 5,042,040 tons in 1937. The cargo handled totalled 1,933,525 tons in 1938, a decrease of 84,887 tons on the previous year's figure. Passenger traffic declined by 15,106, the totals for 1937 and 1938 being 80,134 and 65,028 respectively. Despite this temporary setback, which, in fact, has been fairly general, the Port of St. John looks forward confidently to a progressive and successful future.

The Bay of Fundy deserves some special mention. It is 145 miles long and almost 50 miles wide at its mouth. The tidal flood from the Atlantic piles up in the funnel-shaped inlet to a height of over 50-ft.—even over 60-ft. on occasion. This renders the bay difficult to navigate, as the current is rapid and violent. Besides the St. John Estuary, there are subsidiary inlets of importance in Passamaquoddy Bay, Chignecto Bay and Mines Basin.

The St. John River, with a length of 450 miles, is navigable for about half its course up to the point where it forms the boundary between Maine (U.S.A.) and Canada.

As will be seen in the Paper by Mr. E. G. Cameron, the physical conditions of the locality present several interesting problems in constructional engineering for the consideration of the harbour engineer. Foremost among these is the influence of the tidal range which, while it does not attain at St. John the maximum mentioned above for the Bay of Fundy, is nevertheless of considerable proportions and greatly in excess of the limiting standard which in European waters would lead to the adoption of a closed dock system. Apparently, the inconveniences usually attendant on a rapidly fluctuating deck level have not been found insuperable in the handling of cargo, but this aspect of the matter is not dealt with in the Paper. Probably owing to the predominance of the export of grain, the question does not arise.

Deepening of Belfast Harbour.

Considerable satisfaction will be felt in Northern Ireland at the conclusion, after protracted negotiations, of an agreement between the Government and the Belfast Harbour Commissioners respecting the amount of financial assistance to be given towards dredging operations in the channel in connection with the extension of shipbuilding facilities at the yards on the River Lagan. Before the British Admiralty were prepared to consider the placing of an order for a new battleship with Messrs. Harland and Wolff, probably to be followed by other orders, they insisted that a certain amount of channel deepening should be carried out, the cost of which is estimated to amount to about £400,000.

The allocation of this expenditure, as between the Government of Northern Ireland and the Harbour Board, was the subject of such persistent controversy, that, at one time, it seemed as if a deadlock had been reached. The Government made an offer of 25/- for every 20/- contributed by the Board, who protested that this arrangement would involve the raising of port dues to such an extent that trade would be driven from the locality.

Eventually, agreement has been reached after a final conference between the Minister of Finance, accompanied by the Financial Secretary to the Ministry and representatives of the Harbour Commissioners. The Government's offer is accepted. Messrs. Harland and Wolff will make a contribution of £20,000 towards the scheme, and will be responsible for the provision of the heavy lift crane, which will be a necessary feature, but was not included in the original estimate. Furthermore, the Northern Government, appreciating the fact that the Harbour Board are bearing a serious loss in respect of the harbour airport, will ask Parliament to make a grant of £3,000 per annum from April 1st next towards this loss. At present, the Board are in receipt of a grant of £1,500 a year, dating from September 6th, 1937, towards the maintenance expenses of the airport.

With this concession the Harbour Board are satisfied, and the way is now clear for a revival of the shipbuilding industry of Belfast—a matter for congratulation on all sides.

Eire Port Statistics.

A report issued by the Government of Eire on shipping at the ports of Southern Ireland during the year 1937 shows that, as compared with 1927, the total tonnage of entrances increased by 285,000 tons net (about 3 per cent.), while entrances with cargo increased by 1,322,000 tons (about 20 per cent.). The actual number of entrances is less, indicating that the average net tonnage per vessel has risen.

As regards clearances, the percentage increase is approximately the same for the total net tonnage, and 11 per cent. for clearances with cargo.

Over 90% of the total shipping of Eire is now concentrated at the following eight ports: Cobh (Queenstown), Dublin, Dun Laoghaire (Kingstown), Galway, Cork, Waterford, Rosslare and Limerick. In 1927, Cobh was the only port of call for Atlantic liners. Since that date two other ports have been scheduled as such: Galway in 1928, and Dublin in 1933.

Editorial Comments – continued

New Arctic Ports.

Limits imposed on navigation by climatological and physical conditions are becoming more and more relaxed with the advance of scientific knowledge and technical skill. Ports, which at one time were blockaded during the winter season by ice as effectively as if by naval power, are now able to continue to function in spite of the severity of the weather, through the use of powerful ice-breakers, so that a thermometric range considerably and persistently below zero is no longer proving an obstacle to water-borne commerce.

The latest instance of this increasing freedom of trade movement is the announcement that the Soviet authorities intend to construct three new ports actually within the Arctic Circle. They will lie on the sea route along the northern coast of Siberia, viz., at Dickson Island in the Kara Sea, in Tixie Bay at the mouth of the River Lena, and in Providence Bay, near the Bering Straits. Investigations have been in hand for some time into the range of temperature and the direction and force of currents in these northern waters, with results that promise favourable developments. There is even an idea of establishing a chain of ports along the Arctic coast of Russia, so as to serve as coaling and supply stations for shipping plying on northerly routes. The old dream of the "North West Passage" fondly entertained by navigators of bygone days may, after all, prove to be a practicable proposition, if the way is paved by the realisation of a corresponding reliable northerly route in the Eastern Hemisphere.

St. Ives' Harbour.

The tragic occurrence during the night of January 22-23, in which seven brave men of the crew of the St. Ives' lifeboat lost their lives in response to the call of duty, when summoned to the rescue of an unknown vessel, subsequently conjectured to be the s.s. "Wilston," which foundered the same night with 32 hands on board, has focussed attention on the lack of proper and adequate harbourage in the Bay of St. Ives. In the appeal made by the Mayor through the press, which is published in this issue, it is pointed out that the notice of Government Departments has frequently been directed by the representations of the Town Council to the urgent need for a breakwater capable of affording shelter to shipping which may be driven to find refuge in the bay. It is true that there is a small breakwater in existence, but it is quite ineffective as regards protection on a scale commensurate with modern needs. Indeed, the present harbour is merely a recess for fishery craft. What is needed is a more capacious enclosure of the character of a National Harbour of Refuge, formed by a breakwater of substantial proportions.

St. Ives Bay lies in an outstanding position on the North coast of Cornwall, in close proximity to Land's End, and is, unfortunately exposed to the full force of Atlantic seas. The district is liable to remarkably sudden changes of wind, and the coastline from Hartland Point to Land's End, a distance of 75 miles, is particularly dangerous for shipping. Vessels from the Bristol Channel encountering heavy gales from the South-West to the North-West are sometimes compelled to run back to Lundy or, alternatively, to make for St. Ives Bay, where, as the Mayor points out, when the wind veers to the North-West, vessels often drag their anchors and are driven ashore.

The project for the creation of an effective deep-water harbour at St. Ives has been the subject of numerous enquiries and reports, dating back to a Royal Commission, appointed in 1859, which after reviewing the nature and magnitude of the coasting trade round Land's End, expressed the view that the claims of St. Ives to a national harbour were perfectly valid, and recommended a grant of £400,000 for the construction of a breakwater, 3,750-ft. in length. In our issue of February, 1922, some particulars were given of the proposal and its inadequacy for the purpose intended. Other designs were subsequently put forward but, in the result, despite much discussion, nothing has been done.

At the present time, another point of view presents itself, arising out of the possibility of an outbreak of hostilities and the danger to merchant shipping of submarine attack. It would be an undoubted advantage, from a national point of view, if vessels could find easily accessible shelter near the outermost spur of the western mainland, and if a local base were provided there for the accommodation of the country's defensive naval forces.

The matter is of so much urgency and importance that it has been raised in the House of Commons, and the Government have stated that it is under examination. The sympathies of our readers will undoubtedly be extended to the fishermen of St. Ives, and particularly to the relatives of the gallant men who sacrificed their lives in their noble attempt at rescue of a ship in distress. It would be a fitting response on the part of the nation to provide the funds for a scheme of a magnitude which is quite beyond the modest resources of a fishery community.

Dry-Dock Launches.

The uses of a graving dock are fairly numerous, but it is not often that one discharges the function of shipbuilding stocks and serves for the purpose of launching a vessel. This, however, has recently been done in the case of the French 35,000-ton battleship "Richelieu," which was built in a naval dry dock at Brest, and launched, or more strictly speaking, floated, by admitting water into the dock, instead of by the more usual practice of sending the ship sliding down timber ways into the water. The limitation in length of the dock, which is only 200 metres long, had the curious consequence of rendering it impracticable to complete the hull of the vessel therein, so that it had to be transferred to another dock for the purpose.

This point, and others connected with it, have raised the question whether, after all, it is wise procedure to divert a graving dock from its more legitimate functions of repairing and painting, to the actual construction of a ship. Shipbuilding is a lengthy process, and the monopoly of a dry dock for a long period at a port where such facilities are none too numerous, is somewhat to be deprecated, since there may be insistent calls for attention to damaged ships. Whether dry docks should be specially built for ship construction is another question and depends upon the relation of the comparative cost of docks and slipways. A dry dock, undoubtedly, in the generality of cases, is more costly to construct, but is less expensive than a normal slipway to maintain, since in the former instance the fabric is mainly stone, concrete or other durable material; and in the latter, with its numerous columnar supports for overhead travelling cranes, mainly steel.

From an operative point of view, the "launching" of a ship is much more easily effected in a dry dock, since it is only a question of admitting water to the dock in order to float the vessel, which simply rises from the keel-blocks; moreover, this is a step which can be taken at any stage after the shell plating is completed as far as the main deck. Slipway launching, on the other hand, involves the provision of a double line of fixed ways for a distance which must be in excess of the actual length of the ship, and probably appreciably so, in order to extend below the water line. Moreover, at and about the time of launching, there is the troublesome and anxious process of releasing the blocks, and the risk that, instead of working to schedule, the vessel may refuse to move, or may stick in the descent, as has happened on more than one occasion. Indeed, from one point of view, this possibility provides the thrill of excitement which is closely associated with the "christening" process and constitutes, perhaps, one of its chief attractions to the spectators.

Altogether, the question is not easy to decide, and it may well evoke a controversy without conclusive result.

Mercantile Shipbuilding in 1938.

The Annual Summary for the year 1938 of the Mercantile Shipbuilding of the World, issued at the beginning of last month by Lloyd's Register of Shipping, was notable for the fact that it showed that the tonnage launched in this country, just over a million tons, was the highest since 1930, and this would cause a feeling of satisfaction, were it not, unfortunately, equally true that only half a million tons is now in course of construction, and that as these contracts draw to completion, unless there is a striking increase in orders for new merchant vessels, a period of slackness for British yards must inevitably ensue.

The position in regard to the alarming depletion in the number of vessels in the British Mercantile Marine and the consequential effect on British food supplies in war time has already been commented upon in these columns, and there is no need to emphasise again the warning conveyed by these figures, which is already fully appreciated in responsible quarters.

Another disquieting feature is the loss of orders from abroad, as distinct from home requirements. In times past, such orders were plentiful, but now foreign nationalities supply their own needs to a very large and increasing extent.

It is of interest to note that the average tonnage of steamers and motor ships launched during the year is 4,170 tons, including the "Queen Elizabeth." If vessels of less than 500 tons are excluded, the average is increased to 5,266 tons, as compared with 4,186 tons in 1937; 3,928 tons in 1936; 4,831 tons in 1935, and 4,656 tons in 1930.

The Kiel Canal.

The announcement in the press of Herr Hitler's decision to enlarge the Kiel Canal is more of naval than of commercial significance. It is stated that the width of the canal, which connects the Baltic Sea and the North Sea, will be approximately doubled in certain sections, and the depth increased by about 4-ft. The Canal, which has a length of 61 miles, was originally constructed in 1895 and subsequently widened between 1907 and 1914. The present width is 144-ft. and the depth 36-ft. There are locks at Holtenau and Brunsbuettel.

Saint John Harbour, New Brunswick

Engineering Problems Encountered in Wharf Construction*

By E. G. CAMERON, M.E.I.C., Principal Assistant Engineer, National Harbours Board, Canada

Tidal Conditions

THE problems encountered in major wharf construction in the Harbour of Saint John are attributable to phenomena of Nature.

The Fundy Tides are of world-wide renown, and may be ranked among the seven wonders of the world. Their advantage in the early days of tidal wharf construction, when their extreme range was a material asset in eliminating submarine construction operations, vanished with the increasing size of ships and the demand of commerce that its carriers be accommodated with berths at which they might lie afloat, approach or leave at will, quite irrespective of tidal conditions, converted this former asset into a much greater liability.

Fig. 1

The extreme tidal range in the Harbour of Saint John is 28-ft. This is equal to, or greater than, the loaded draught of all but the largest of the present day ocean cargo carriers and 3-ft. in excess of the draught now provided in the Welland Ship Canal between Lakes Erie and Ontario, and the ultimate draft proposed for the St. Lawrence deep waterway. In consequence of this extreme condition, wharf structures in Saint John Harbour must be of unusual height, practically double that of wharves in non-tidal waters for the same usable draught.

Not only does this condition introduce difficulties consequent on having to go to greater depths for foundations, but it necessitates the adoption of special features in design to obtain rigidity and stability in wharves of unusual height. Again, this condition creates the problem of providing for permanence in wharf structures subjected to the destructive action of the elements, occasioned by the alternate submergence and exposure in the air of a great extent of their height, while this action is accelerated, to a greater or lesser degree, dependent on the type of fendering provided, by the constant movement of moored ships up and down against such an extent of the wharf face.

In Saint John Harbour, the difficulties attendant on the alternate wetting and exposure of this height of the structure to the air, are accentuated by the below-freezing air temperature which prevails during the winter months, when shipping activities reach their annual peak due to the winter closing of the St. Lawrence River ports. While Saint John Harbour winter temperatures are moderated by proximity to the ocean, and solid ice is unknown in this harbour, temperatures of zero to twenty degrees below are often experienced, and structures, particularly of concrete, constantly exposed to alternate wetting and freezing, must be of the most durable construction to withstand this condition. The means employed and the results obtained in this regard in the latest and more important wharf projects of Saint John Harbour will be of interest.

Foundation Difficulties

The problems occasioned by the deep foundations necessitated by existing tidal conditions are similarly complicated by the peculiarity of subsoil conditions. It is to be observed that the rock formation much in evidence about the harbour and chiefly shale with trap obtrusions, is extremely distorted. Instead of being found in the original state of deposition, with stratifications approximately horizontal, these, instead, are folded and tilted at an angle of 60 degrees or more from the horizontal, with the exposed irregular surface fissured and heavily faulted in outline. This rock condition prevails throughout the whole area underlying the harbour. Overlying the rock and equally variable in depth, outline and character, are deposits of boulder clay, gravel, soft clay and river silt, over-topped in many areas by artificial accumulations of rock, earth and debris fill, old cribwork, slabwood deposits from earlier lumbering operations; all these latter marking the gradual expansion of the harbour berthing facilities from its earliest days of small wooden tidal wharves, built along the original shore line of the mouth of the Saint John River in the seventeenth century, to the present day deep-water berths, at which ships drawing up to 35-ft. can lie at all stages of the tide. The methods employed in obtaining satisfactory foundations for the more recent and modern structures built in Saint John Harbour, under these adverse conditions, have represented the accomplishment of difficult and, at times, hazardous undertakings, and yet without any single accomplishment furnishing a solution applicable to all foundation problems in the harbour.

Influence of Marine Organisms

Until very recent years, timber has been the principal material employed in Saint John Harbour wharf construction, and rock-filled timber cribs were for many years the type generally used and found best suited to local conditions. Two factors were primarily responsible for this: the proximity of abundant stands of fine spruce timber, and the freedom from infestation by marine borers.

Because of the low temperature of the Bay of Fundy, which controls the water temperature in Saint John Harbour, the Teredo is unknown, but the Limnoria and Nacerda are present. Nature, however, has provided for the protection of timber in the harbour from the depredations of the destructive Limnoria in a very interesting way, while the activities of the Nacerda, being confined only to unsound timber above high-tide level, have not been of serious consequence, due to the general adoption of concrete for wharf decks since the disastrous fire of 1931.

The Limnoria, which only attacks timber constantly submerged in salt water, begins its attack on the exposed timber surface and effects destruction by the successive honeycombing of the sound timber surface left by each preceding attack. But as this borer requires for existence a constant fresh supply of salt water, it must confine its attacks to not over one-half inch of the timber surface, in the form of burrows, as illustrated in Fig. 1 above.

* Paper read at the Annual Meeting of the American Association of Port Authorities, September, 1938.

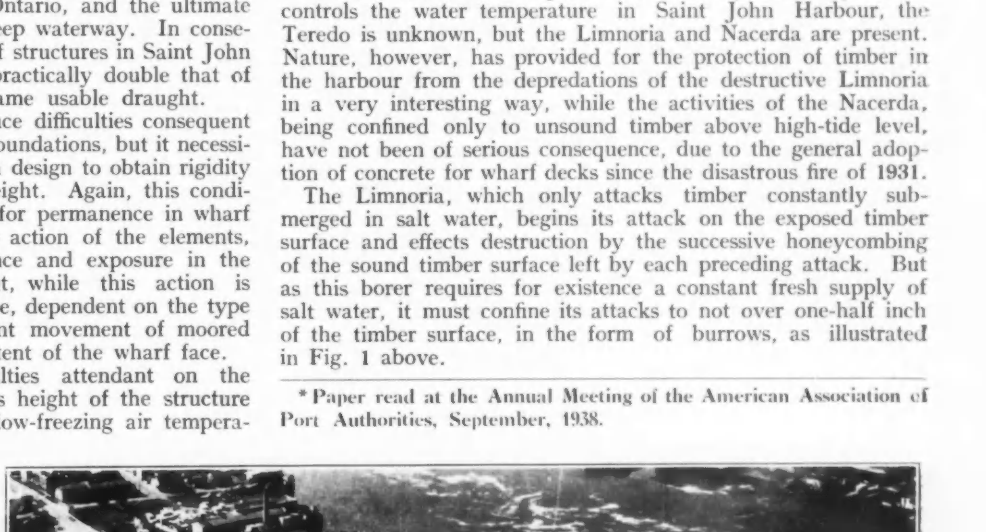


Fig. 2. Aerial View of Site

Saint John Harbour, New Brunswick—continued

The Limnoria can exist only in salt water having a constantly maintained salinity in excess of ten parts in one thousand, and the dilution of sea water below this degree of salinity for a period of twenty-four hours or more, is fatal to all Limnoria present therein. From an extended study of the habits of the Limnoria, biologists have found that a new colony of these borers will not infest a timber surface previously attacked by other Limnoria colonies that have been destroyed.

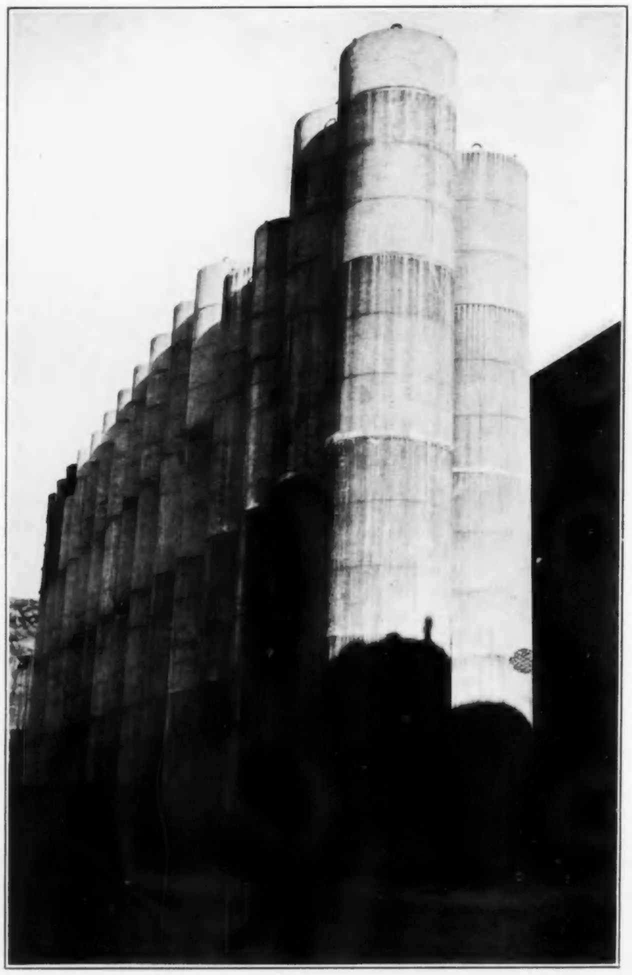


Fig. 3. Concrete Cylinders

As Saint John Harbour receives the entire fresh-water discharge of the Saint John River which, at spring freshet time, approximates a mean flow of 67,000 cu. ft. per sec., there is a period of each year during which the salinity of the harbour water is reduced below that necessary to maintain Limnoria life. This brings about the annual eradication of all borer colonies infesting timber work in the harbour. As the annual attack of Limnoria represents only a timber penetration of not over one-half inch from the surface, and each attack is followed yearly by the complete destruction of the active colonies, that leave behind superficially honey-combed timber which succeeding new colonies will not infest, timber structures in the harbour after one year of Limnoria attack, which does no material damage, become immune to further borer depredations.

The destructive fire of June, 1931, which practically wiped out all of the deep-water facilities of the harbour, then constructed entirely of timber, largely brought about the adoption of more fireproof types of wharf construction in which, however, the use of untreated timber continued permissible in the submerged portions, due to this immunity from marine borer attack.

Even with this element of relief, many difficulties remained to be met and overcome in the construction of recent important additions to the wharf facilities of Saint John Harbour, by reason of conditions imposed by tide, temperature and subsoil. The methods employed in meeting these situations can best be illustrated by presenting some features of the Navy Island and Berth 8, 9 and 10 projects, by which six modern commodious berths were added to the West side facilities of the harbour.

Navy Island Development

In 1927, when the Federal authorities purchased the interest of the City of Saint John in the harbour and placed it under Commission control, the facilities then available were found inadequate to meet the demands of shipping using the port, and a further extension of the then existing West side berths in the North, and most protected part, of the harbour, was determined on, and an initial project undertaken to provide a 700-ft. pier and adjacent marginal wharf of similar length, with a 1¼ million bushel capacity grain elevator at the rear, giving, in all, three berths aggregating 2,260-ft. in length, with a minimum usable draft of 35-ft. at extreme low tide.

Investigation of the site disclosed the rock surface varying from above high-tide level to 53-ft., and more, below low-tide level, and overlaid with the characteristic variable deposits of boulder clay, gravel and silt.

To attempt this construction as a submarine project, not only limited the type of structure to a massive timber or concrete crib structure, requiring the removal of a very large quantity of rock by submarine methods, which would be extremely expensive because of the tilted, folder and fissured character of the rock formation, but introduced as well the difficulties of obtaining uniform support for and stability in a type of structure that, without a prohibitive amount of further excavation must be founded in part on solid rock, and in part on clay or other less resistant material. An equally important consideration was the question of obtaining durable concrete where placing and curing operations would be subject to the detrimental effect of the semi-daily submersion of all concrete work in the tidal range.

These considerations brought about the decision to unwater the site so that all operations might be carried on in the dry, thereby not only materially reducing the quantities of earth and rock excavation, as well as their costs, but permitting the use of an economical type of concrete structure embodying a pier and arch sub-structure and gravity section superstructure, all uniformly founded on solid rock (see Supplement) and requiring a smaller quantity of concrete than necessary for the type of structure suited to submarine procedure. The additional degree of permanence obtained by unwatering, permitting the placing and adequate curing of the concrete under conditions

Fig. 4. Cylinders in East St. John Dry Dock

which allowed through field control and inspection of all concrete operations, was of great value, but these advantages were only obtained after a long struggle with the problem of unwatering the site.

Adopting an outlining cofferdam of rock and gravel-fill, deposited on the existing harbour bottom to support a cut-off, first of wood sheet piling with medium penetration and, latterly, of steel sheet piling, up to 90-ft. in length, driven to rock or other hard material, two unsuccessful attempts were made to unwater the 43-acre site. Each attempt met with failure,

Saint John Harbour, New Brunswick—continued

because of undue reliance in the material of the harbour bottom. This blew out under the wood sheet piling, or subsided under the superimposed weight of rock-fill on the inside of the steel pile cut-off, when the support of the water on the inner side was partly withdrawn. With the removal of the rock-fill support from the inner side of the steel pile cut-off, this in turn failed when subjected, without support, to high tide hydrostatic pressure.

By adopting the expedient of dredging out a quantity of the materials of unknown or variable stabilising value from inside the steel pile cut-off and replacing this with gravel of definite supporting capacity, the required cofferdam stability was obtained, the 43-acre area unwatered and readily kept dry, although foundation excavation for the outer end of the pier extended to a depth of nearly 75-ft. below high-tide level, and the structures completed under the favourable conditions originally contemplated. (See Aerial View, Fig. 2).

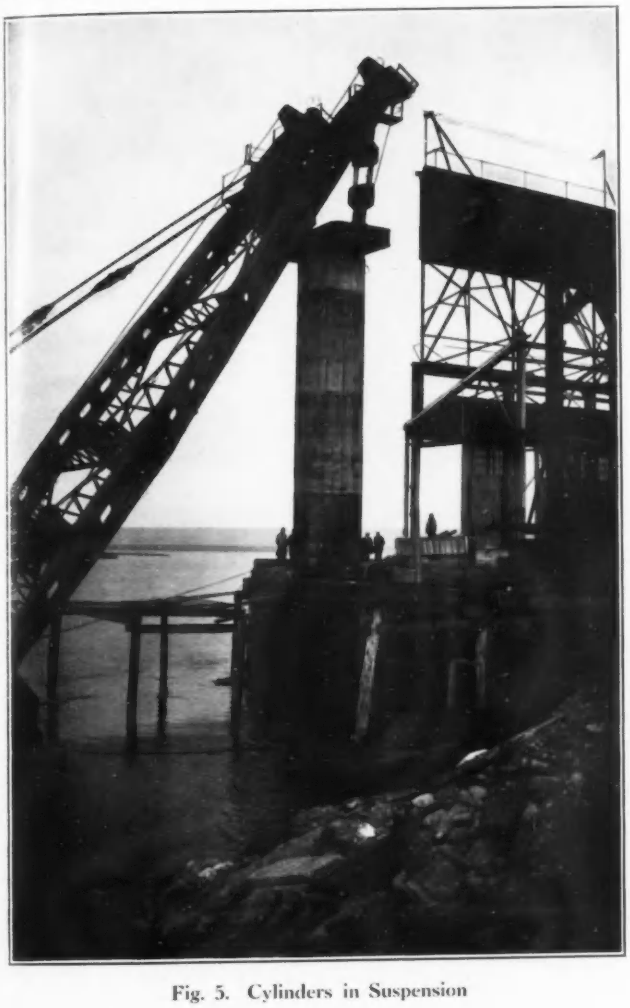


Fig. 5. Cylinders in Suspension

The present excellent condition of these wharves, entirely free of any signs of settlement or displacement, and the concrete in the tidal range unimpaired after several years of exposure to the extreme conditions already described, amply justifies the solution applied to this problem.

For those desiring more detail of this undertaking than present space permits, reference is made to the paper thereon published in Part 1, Volume 239, of the Proceedings of the Institution of Civil Engineers of Great Britain, and in the issue of Engineering News Record of February 15th, 1934, under the authorship of Mr. Alex Gray, Port Manager, Saint John Harbour.

Reconstruction of Berths Nos. 8, 9 and 10

While an outstanding reconstruction record was made in the replacement in six months of some 4,000-ft. of the West side wharves and sheds destroyed by fire in June, 1931, when all the wooden wharves, sheds and grain-handling facilities on the West side of Saint John Harbour were burned to mid-tide level, this was only made possible by the lower undamaged part of the original cribwork being found in sufficiently good condition to permit its use as a foundation for new concrete decked timber wharves, limited to 30-ft. draught, and accommodating steel transit sheds and grain-handling facilities.

This favourable condition did not apply in the case of marginal wharves 8, 9 and 10, outlining a large area of land reclaimed on the South side of Sand Point Basin by the successive construction, abandonment and burying of old wharves and their replacement by larger wharves until 30-ft. draught was obtained.

The problems of replacement, therefore, proved of major proportions, particularly as these berths, approximately 2,100-ft. in extent, were most favourably located, and so necessitated being provided with greater than 30-ft. draught, in keeping with the requirements of a modern ocean port.

Though unwatering had proved so satisfactory in the construction of the Navy Island project, this method had no application at Sand Point Basin, the extreme depth of water on the harbour side and the pervious variable nature of the materials in the reclaimed area in rear rendering any scheme of unwatering not only prohibitive in cost, but extremely hazardous in execution. This demanded, therefore, a type of structure in which permanence, uniform foundation stability and reasonable ease of execution were of paramount importance and yet would be obtained, under the existing difficult conditions, without unwatering the site and within the bounds of reasonable cost.

Four years of investigation and study of this replacement problem, crystallised in the adoption of a type of wharf structure with reinforced concrete deck supported on bents of concrete cylinders and timber pile clusters extending to the extremely irregular rock surface below and providing a maximum draught of 35-ft. (See Typical Section on Supplement). With this type of structure, excavation was limited to the removal of the old timber work and the material supported thereby; the casting and curing of all concrete was made possible without exposure during construction to detrimental tidal immersion; the difficulties otherwise arising from the extreme variation of the rock surface, from 38 to 83-ft. below low tide, were overcome, and uniform foundation support was obtained throughout.

After the old cribwork and other materials were removed from the site by dredging, this operation bringing up great numbers of very old squared timbers in perfect state of preservation, reinforced concrete cylinders, 9-ft. in external diameter and 7-ft. internal diameter, cast and cured under conditions ideal for concrete field control in the East Saint John Dry-dock (see Figs. 3 and 4) were transported to the work and placed in position by a floating crane, equipped with special overhanging shear legs, and having a lifting capacity of 150 tons, equivalent to the weight of a cylinder about 72-ft. long. (See Figs. 5 and 6). When in position and held by a system of timber falsework, sinking was accomplished by excavating the cylinder interior until the cutting edge contacted rock. Owing to the variable nature of the materials penetrated and the presence of boulders therein, some cylinders required the addition of loads up to 90 tons, and in such cases, water jetting, and even drilling and blasting, had to be resorted to, while other cylinders reached their rock foundations under their own weight alone. When so founded, each cylinder was filled with concrete and lengthened where necessary to finished height, 15-ft. above low-tide level, in a steel form extension with top above water level and lagged with timber during periods when the water temperature was below 50 degrees F., so that placing and curing was again accomplished under uniformly satisfactory conditions. In all, 205 pre-cast concrete cylinders, varying in length from 50 to 97-ft., were incorporated in the sub-structure, the extreme variation in length adequately indicating the irregular outline of the underlying rock surface. Similar variations in length were experienced with the timber piling in rear column clusters and in the unloading platform provided at the rear of the structure to minimise the risk of slides during construction, this variation being accentuated by the presence of old long abandoned crib wharves throughout the reclaimed area in rear.

After the construction of longitudinal and transverse concrete struts between cylinders and concrete-capped pile clusters, the underlying slope was stabilised by a rock-fill along the toe with this carried as a protective cover up the slope to relieving platform level.

The concrete in struts between cylinders and pile cluster caps, in continuous front and lateral cylinder connecting walls, and in rear wall and columns, extending the structure to deck level, was placed and cured in watertight steel forms, thereby preventing any detrimental effect from the surrounding sea water during high tide periods, and with the two-way reinforced flat slab deck, above high-tide level, placed under most favourable conditions for concrete field control, a high degree of concrete permanence was assured throughout the structure under unusual and difficult conditions. While the fact that the concrete of this structure is still unimpaired, after a year's exposure to the severe test of tide and temperature fluctuations, cannot be taken as a gauge of the structure's permanence, it may be fairly assumed that the above precautions, coupled with the extreme care exercised in the selection, grading and proportioning of concrete ingredients and the valuable experience previously obtained from the construction of the Navy Island project, will all contribute years to the effective life of the latest addition to the wharf facilities of Saint John Harbour. (See Perspective View on Supplement).

Saint John Harbour, New Brunswick—continued

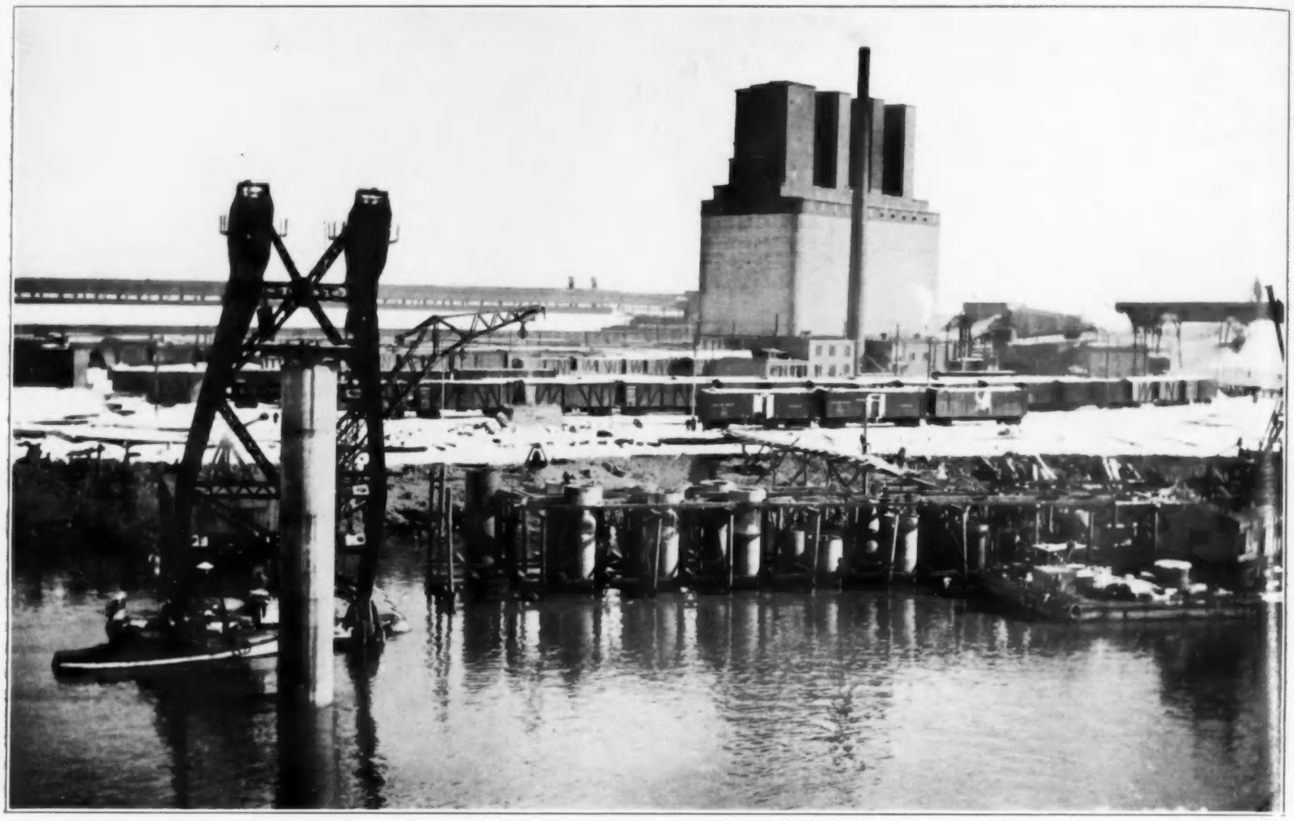


Fig. 6. Setting of Cylinders

Again, for those desiring a more detailed description of this work, reference is made to the paper thereon published in the October 1936 issue of the Journal of the Engineering Institute of Canada, under the authorship of Mr. V. S. Chesnut, Senior Engineer, Saint John Harbour.

The type of fender protection provided for wharves in Saint John Harbour is unusual and of interest to those primarily concerned with maintenance under conditions similar to those at Saint John. Floating fenders are made of a number of small spruce or cedar poles, bound together with wire cable in the form of cylinders 3-ft. in diameter and 30-ft. in length. These provide a rolling fender, necessitated by the extreme tidal range, with maximum resiliency without damage from crushing or bending, and the requisite materials for construction are readily obtainable at low cost anywhere there is tree growth.

In the construction of Navy Island Wharves 1, 2 and 3, and the replacement of Sand Point Basin Wharves 8, 9 and 10, two entirely different types of structure were used and divergent methods of procedure employed. An analysis of the cost of these undertakings, excluding that of sheds and other facilities provided thereon, discloses the interesting fact that the former cost, thirteen hundred and eighty-four ($1,384) dollars, while that of the latter was thirteen hundred and fifty-five ($1,355) dollars per lin. ft. of structure. The close agreement of these costs indicates the uniform magnitude of the difficulties encountered in the solution of problems of wharf construction in Saint John Harbour by any combination of means that may be employed.

Dover Dock Gates

Discussion on Paper by R. L. BIGGART, Vice-President of the Institution of Engineers and Shipbuilders in Scotland*

Mr. A. C. Gardner (President): The work described in this paper is important because the dock serves as the terminal of the cross-channel train ferry service. It is interesting to engineers for several reasons; firstly, on account of the ingenious method adopted to overcome an almost insuperable difficulty when it was found impossible to build the gates in the dry behind the protection of a dam. The decision to construct the sill section of the dock in the form of a steel pontoon enabled the difficulty to be successfully overcome, and the step was a bold one. Only those engineers who have had to do with the setting and alignment of the hollow quoins of a large dock gate will fully appreciate the problem encountered in the setting and alignment of the castings of the horizontal quoin required in this instance. This was built, not on a solid masonry bed as it would have been in the normal way, but in a steel box suspended in mid air, subject all the time to indeterminate stresses arising from wind and wave action, until it was finally founded. And when it was founded, the gate heel had to be lowered into it, and not until both gates had been lowered into position in this way and the water pumped out between them, could the measure of success which had attended these operations be determined. That aspect of the problem, namely, the devising of a successful means of overcoming an unforeseen difficulty—a fairly common necessity in large civil engineering works—is the most interesting feature of the paper.

* Reproduced by permission from the Journal of the Institution of Engineers and Shipbuilders in Scotland. The Paper appeared in last month's issue.

The Box or single-leaf flap gate, for the reasons set out in the paper, seems to be admirably suited to the special requirements at Dover. It could readily be designed to take water pressure on both the front and back faces by the introduction of the strut gates referred to and illustrated in Fig. 8. These wing gates virtually provide the equivalent of a vertical clapping sill on the low-water side of the gates. The Box gate has been well tested in practice; an outstanding example of its use in Scotland is to be found in Barclay Curle's graving dock at Elderslie, and although that particular gate is wider than the gates at Dover, its weight, owing to its lessened height, is less. In the comparatively calm water of the Clyde, gravity alone is sufficient to enable the gate to fall when the stops are released, but in the special conditions obtaining at Dover, where the gates are subject to considerable wave action, pulling-off devices became necessary to ensure the proper lowering of the gate. The gear designed to accomplish this is very simple and effective. The arrangement of pulleys enables the pulling-off force of 30 tons to be exercised during the beginning of the travel where it is needed, and to fade out with the disappearing movement of the gate pulley when it has passed the point where it is no longer required. It would be interesting to learn whether the hydraulic buffer for damping down the too sudden closing of the gate has been thoroughly effective. Is the liquid used in the cylinder, water, or is it a mixture of water and glycerine, or oil? The swinging of the gate in a heavy sea when being raised or lowered must have occasioned the engineers some anxious thought as to the possible loss of control due to the slackening of the haulage ropes. The stenting gear, equally with the pulling-off gear, seems to have successfully overcome this difficulty by an equally simple mechanical device. The method adopted for holding the keel against reverse pressure by means of a continuous check face or bearing sill in the casting, appears to have provided what is required, but there must, in certain emergencies, be occasions when this face will be

Dover Dock Gates—continued

called on to withstand very heavy local pressure. It will, in fact, amount almost to a line pressure. Perhaps the Author will state whether it is a metal-to-metal contact and what the maximum pressure is under the worst conditions.

The equalisation of the pull on the two haulage ropes was accomplished by the use of Austin control gear, in the same way as in the Barclay Curle gate, but the introduction of friction clutches in the winches to limit the maximum load on each rope to 60 tons is quite a new feature. In Fig. 12 the maximum pull on the main hoisting ropes under the condition of immersion shown would occur at about 45° or 50°, but it is not apparent why, when the gate reaches a position of about 70°, the puil required should rise so steeply as shown in the curve in the process of its being hauled home. Perhaps the Author will explain this.

It would have been interesting to see, in addition to Fig. 8, a cross section of the sill girders of the pontoon. The construction here must have been very heavy to ensure the requisite rigidity in the structure in the process of its being lowered into place, but as a solution of the problems presented by the unforeseen difficulties encountered, it is deserving of very high praise. In Fig. 9 reference is made to the use of a box gate spanning an entrance 140-ft. in width. This, presumably, has no reference to work contemplated at Dover, but shows the possibility of its use with the wing or strut gates referred to. Possibly it is introduced in the paper with the expectation of favours to come.

It is interesting to note that the use of a tank model played such a useful part in enabling the designers to arrive at the form and character of the special devices used to operate the gate under the sea conditions prevailing at Dover, and illustrates the practical value of such experiments in the hands of competent and experienced observers.

Prof. G. Cook (Member): In the opening paragraphs of the paper the Author states that the special features of the work calling for research would be a matter of general interest. He is certainly right in this view; but it would have added greatly to the interest if he could have included more details of the experimental work on which the design was based. He refers to certain model experiments carried out to ascertain the probable behaviour of the gates both in calm and rough weather. The prediction made over fifty years ago by Prof. Osborne Reynolds that the time would come when no important harbour works would be undertaken without a preliminary study on the model scale, has in recent years been fulfilled, but the problems associated with this method of study have not yet all been solved, and the confidence with which the results can be accepted are enhanced in proportion as the accuracy with which the laws underlying the method are shown to be fulfilled in actual investigations. The accumulation of knowledge in this subject is so important that no opportunity should be lost of placing on record in some detail the results of any investigation undertaken. One field in which knowledge is particularly deficient is that of the effect of waves on engineering structures, and the Research Committee of the Institution of Civil Engineers is now studying this problem both on the model and on the full scale. The Author mentions that the forces required to operate the gates were estimated from the results of the model tests, but he says little about how far the predictions were confirmed. There is, for example, no mention of the scale of the model.

It is astonishing to learn that in an enclosed harbour such as Dover it should be necessary to provide against waves from 6 to 7-ft. in height. A 6-ft. wave is a considerable wave even in the open sea, and even if it were practicable to open the gate in such conditions, would not the effect of waves of this height entering the dock with a vessel in it be serious? Does the Author know whether the gates have actually been opened against a sea of this magnitude?

In view of the fact that in the normal operation of the dock the pumps are required to maintain a difference of level between inside and outside of at least 16-ft., it is not clear why it was not possible to pump the dock nearly dry for, at all events, a short period about low water.

Mr. J. Thomson (Member): It is very appropriate that this paper describing the Box gate, or flap gate, should be given by the Author, for ever since the Barclay Curle gate was installed he has defended its use consistently and successfully. It might be thought that there would be great danger with this type of gate through the recess in the floor being sealed up or blocked with sunken timbers. However, experience with numerous other similar installations has proved all such fears to be quite unfounded.

The most difficult part of the construction of these gates is the machining of the sills and heel posts. This is a very fine operation, and the Barclay Curle gates were set in a vertical and a horizontal plane over a distance exceeding 80-ft., to within $\frac{1}{32}$ in. The greenheart timber has to be dressed with an almost equal degree of accuracy. The machining of the sill is an ordinary operation carried out on the planing machine with a swinging head working with a tool and then a grinding wheel. There was no difficulty in doing that but, as the Author says, the planing of the greenheart is the work of specialists, and specialists are always a nuisance. They are difficult to get and they die out, and if someone could introduce a method of machining the greenheart other than that described by the Author, it would be very welcome. It is difficult to believe that some method cannot be adopted whereby, without a specialist but with a good mechanic, equal or better results could be obtained. In this connection it may be mentioned that during the construction recently of a large number of penstocks for the Singapore Docks it was found that the greenheart could be machined in ordinary mechanical planes with a tool about 1-in. in breadth, and the work done previously by hand was done in a fraction of the time and at a fraction of the cost.

The Author states that the strut gates were held in place by means of a conical wedge. This is hardly correct, although an attempt was made to use a conical wedge for this purpose. However, it was found, as is quite obvious, that the conical wedge is quite unsatisfactory because we wanted it to expand only in one plane, namely, in the plane of the strut gate. Ultimately, we had to use a wedge formed of cylindrical surfaces with their axes at an angle to one another, that is, a wedge with curved surfaces.

Mr. E. Bruce Ball (Member): Has the Author any reports on the operation of the gates since their installation? It has been stated that the action of the waves brings in a great deal of sand and shingle which has caused trouble to the dock authorities and probably also to those who constructed it. Doubtless the Author has devised some special means to clear this accumulation, and it would be interesting, as a corollary to the paper, to learn what was done.

In referring to the operating machinery, the Author states that the Barclay Curle gate is operated by means of two winches with electrical gear, and this gear, in one important aspect, functions in a similar way to hydraulic gear in that it can be stalled under full load for some 30 or 40 minutes. This is a most desirable application of electrical gearing, because hydraulic engineers provide for this stalling, and it would be of value if the Author would explain how it is done with electrical gear.

Mr. J. Williamson: The failure of the cofferdam as a result of the heavy seas was hardly anticipated by the engineers familiar with the conditions at Dover. That failure and the subsequent investigations decided the engineers to abandon their first scheme of operations and embark upon a different method involving the construction of the walls in the wet; that is to say, the concrete side walls of the dock were constructed of blocks set by divers and grouted up in the water, which is never an easy job. It was expected then that after the dock walls had been constructed and the end closed by means of the ship caisson, it would be possible to dewater the dock and put in the floor and sills in the dry, including the sills for the Box gates. An attempt was made to pump it out, but even with a huge installation of pumps the water level could not be lowered, and again an alternative method had to be found. It was only by the close collaboration of the engineers of the Southern Railway, the general contractors and the constructors of the gates, that a successful solution of this difficult problem was ultimately found.

It is interesting to know that the engineers familiar with the chalk at Dover did not anticipate much difficulty in pumping the water out of the dock. There are tunnels and chambers running into the cliff not far above tide level, and they are quite dry and without fissures. There are also railway tunnels a short distance further back which must have afforded some of the easiest tunnelling work in this country. In some of these the chalk forms the side walls and stands up firm and solid showing the original pick marks, and a brick arch resting on the chalk supports the roof, but there is hardly a drop of water in them and no noticeable fissures. In connection with the channel tunnel project brought forward a number of years ago, a trial tunnel was run underneath the sea for a considerable distance not far from Dover, and there again the chalk was found to be absolutely solid and unfissured and did not let in any material volume of water. It is therefore astonishing to learn that the chalk on the foreshore was fissured to such an extent as to render it impracticable to lower the water level in the dock.

Mr. F. F. Burrowes (Member): From the constructional side of engineering works an interesting point in this paper is the ingenious method by which the two gates were used to form a temporary cofferdam, thus enabling the sill castings and quoins to be inspected and corrected if necessary before being concreted in. Not having the full data, it is difficult to give an opinion, but from a paper read on the whole works at Dover it appears that the difficulty in dewatering the large cofferdam was due to the inrush of water through deep fissures in the chalk. As the President has emphasised, it is a delicate operation to set the sill and quoins for a dry-dock, and perhaps the Author will say whether some other method than the pontoon

Dover Dock Gates—*continued*

was considered. It would have been quite an easy matter to construct a small cofferdam just round the site of the gates. With the 5 to 7-ft. of concrete forming the bottom of the dock, reinforced if necessary, the dewatering would have been possible and the operations could then have been carried out in the dry.

Mr. Allan Stevenson (Vice-President): The procedure for the operation of the two gates is not clear. Do both gates open outwards, and are both operated each time a ship enters or leaves the dock, or is one permanently under water and only one gate in use? If both are used, are they operated at the same time, or one after the other?

Mr. H. J. Prior: What arrangement was made for the preservation of the steel and how often is it anticipated that the gates will have to be removed for re-coating with the protective paint or bitumastic compound used?

Mr. J. M. Baxter: Reference has been made in the discussion to the Austin gear, and it may be of interest to explain that the motors give automatically full load speed at full load torque varying approximately to twice full load speed at no torque and twice full load torque at no speed. This characteristic was utilised during the trials by taking note of the speed of the motor over periods of 15 secs, and plotting down from these speeds the pull on the ropes. One of these graphs is shown in the paper.

Another point which should be explained is in connection with the slipping brake on the winch. The stenting gear is quite obvious for taking up the slack one way, but the other way, when the gate pulls down, a special slipping brake connected through epicyclic gearing to the winch drive, allows the rope to pay out under controlled resistance.

Incidentally, would it not be possible to make the clapping faces inclined and so cut out the pulling-off gear?

Dr. Brysson Cunningham: This paper deals with a subject of considerable interest to dock engineers, and it is a matter for astonishment that so little effort has been made to develop the design of dock gates on the single-leaf or flap-gate system. It is much more than twenty years since the first flap gate was installed. The writer recalls a flap gate closing an entrance of about 40-ft. in width at one of the private graving docks of Clover, Clayton & Co., at Birkenhead, in the early years of the present century, and another (35-ft. in width) was then in existence at Port Dinorwic, North Wales. He inspected the former of these while in the service of the Mersey Docks and Harbour Board, and was much impressed by its efficiency and suitability. The Birkenhead gate differed from the Dover gates in having a single-plated face with a flotation chamber at the top of the gate. Giving a description of the gate in his "Dock Engineering," first published in January, 1904 (page 309 in the 3rd edition), he added: "The success attending this type of gate is sufficient to warrant its introduction on a larger scale." So far as he knows, however, apart from the Elderslie gate, mentioned by the Author, and the Dover gates, there is at present no notably large gate of this type in use, although it is quite evident from the paper that such gates could be well adapted to entrances of very considerable width.

The drawback to the flap gate for dock entrances where the sills are practically flush with the river channel, is the necessity of forming a recess in the floor of the entrance to receive the buoyancy chamber or chambers, which are of appreciable depth. This entails careful attention to the recess to remove accumulations of mud and silt, an operation which may not be without some difficulty and inconvenience. There is the risk that if the matter is not properly dealt with, the gate may not lie sufficiently below the level of the sill to avoid fouling the underside of a vessel passing through the entrance. Apart from silting of the recess, a chance obstruction may produce the same effect, and it may be asked whether there is anything in the nature of an automatic indicator at Dover to give definite evidence that the gate lies completely below sill level. There is certainly a fairly large margin of clearance.

The abutting faces of the gate and side quoins at Dover appear to be of wood. At Birkenhead, there was a strip of rubber, 2-in. in width, attached to the woodwork to ensure water-tightness. Is there a similar strip at Dover, or what other means are taken to achieve that end? The method of setting the gate by means of a floating pontoon sill is ingenious and interesting, the only conceivable doubt being in connection with the efficiency of the grouting of the space between the pontoon and the dock bottom, but the operation seems to have been carried out with great care.

With a view to a comparison of the flap gate with gates of the double-leaf type, some indication of the cost of the flap gates at Dover would be welcome.

Mr. W. Howie (Member): It has been stated that in some gates similar to those described by the Author it was necessary to instal a pump, fitted with the necessary piping and nozzles, for the purpose of clearing any accumulation of sand or mud from under the gates before they are lowered. Was such a pump required for the Dover gates?

The Author's Reply: Mr. Gardiner's first question refers to the hydraulic buffers. In practice it has been found that the pull-off gear is very effective, and it is only when the gates are being opened or closed against waves of from 4 to 5-ft. in height that the buffers are called upon to act. They have been in action on one or two occasions and functioned satisfactorily. The keel of each gate carries a gun-metal bearing strip 2½-in. in width by ½-in. in thickness, which runs the whole width of the gate. The bearing pressure under the worst conditions of loading is 6 cwt. per sq. in. The steep rise in the curve in Fig. 12 at the 70° position is due to superimposing on the main haulage ropes an additional loading from the pull-off gear.

No gates have so far been built for a dock entrance of 140-ft. (Fig. 9), but a tender has been submitted for such a design of gate. In this particular instance, due to the small variation in tide, the maximum pull called for from the lifting winches is considerably less than for the Dover winches although the gate was larger.

Prof. Cook is disappointed that the special features of the work calling for research were not dealt with in more detail. The Author referred to this aspect in his opening remarks. A proper description of these experiments really calls for a further paper. The scale of the model is 1/24th.

At Dover the winch clutches were set so as to slip at a pull of from 50 to 55 tons, and slip took place with waves about 5 ft. in height. The model gate experiments showed slip at a pull of 60 tons with 6-ft. waves. Reference to a map of Dover Harbour will show that the train ferry dock is pointing straight out to sea through the western opening of the breakwater, and with certain winds waves of considerable size are experienced at the ferry dock entrance. The highest wave observed—trough to crest—when the ferry boat was leaving the dock was in the vicinity of 5-ft. With waves of greater magnitude it is doubtful whether the ferry boat would be able to make the dock entrance. The gates have been operated with waves of this height, and there is no reason why they should not be operated satisfactorily on still greater waves.

During the construction of the dock, pumping as a means of dewatering the dock site was proved to be ineffective on account of the fissures in the chalk, and not until after the concrete dock floor—2-ft. 6-in. in thickness and laid under water—had been constructed was it possible to utilise the pumping installation for the ordinary working of the dock. Even then, in order to avoid any risk of an excessive hydrostatic pressure on the dock floor, the Southern Railway placed a limit on the maximum difference permissible between the water levels outside and inside the ferry dock.

Mr. Burrowes suggests that a cofferdam might have been constructed round the site of the gate in place of the pontoon. Some of the fissures in the chalk were practically under the gate sill, and it was obvious, in the early stages of this work, that the chalk was so badly fissured that it was doubtful whether, with very powerful pumps, it would have been possible to deal with this relatively small area by means of a cofferdam. The final decision lay with the chief engineer of the Southern Railway, and it was he who specified the pontoon form of construction.

Mr. Stevenson refers to the operation of the gates. The general procedure is that both gates are operated when a ship enters or leaves the dock. It is not considered desirable to leave one permanently under water, although strut gates are provided which make it possible to operate the dock with only one gate in use. If a vessel is docked at low water, the inner gate is brought up and the water in the dock raised to berthing level. The outer gate is then brought up, so that when the tide rises and passes berthing level (6.5 O.D.), the head of water is then transferred to the outer gate. The process is reversed, of course, when a ship berths at a tide level above the berthing level.

So far as the Author's information goes, there has been no trouble from sand and shingle. Along the coast at this point the shingle travels from west to east, and it is found hard against the west side of the Admiralty pier; the dock, situated close to the east side of the pier, is protected from this trouble. During the construction of the Dover gates, it was thought that there might be trouble from silt, as a considerable quantity gathered at the site of the ferry dock during the building stage. In this connection, the Author has to thank Mr. Bruce Ball for his help in an investigation into a scheme proposed at one time for Dover, for the purpose of dealing with silt. This suggested scheme was a modification of an installation supplied in 1929 for a graving dock at Antwerp, where it was known that the silting problem had been found a troublesome one with other types of dock gate. Fig. 19 illustrates the method adopted. The main discharge culvert, A, was led along the side of the dock, across and through the sill culvert, B, and then through a series of discharge pipes, C. These pipes directed the discharged water from the dock into space D. Immediately after the gate was lowered, water was pumped by means of the main dock pumps from the dock through culverts and pipes, A, B

Dover Dock Gates—continued

and C, and into and through space D, scouring out from the gate recess all silt that might be lying there. In practice, this arrangement was found to be hyghly efficient, and no difficulty was experienced in keeping the gate recesses free of silt.

Another method for dealing with silt which has proved very effective was adopted for the Barclay Curle gate. A series of pipes about 2-in. in diameter was laid on the bottom of, and across, the gate recess. Small holes were drilled in these pipes and, before the gate is opened, air at a pressure of 100 lb. per sq. in. from the shipyard system is blown through them. This stirs up the silt, and when the gate is lowered the water is forced from beneath it and carries the silt along with it. Up to the present these are the only gates that have been provided with special gear for dealing with silt.

Eventually, the Southern Railway decided that it was not necessary to instal special gear for dealing with silt at Dover, and this decision has been proved a wise one. After the gates had been working for six months, the recesses were examined by diver and found to be comparatively free of silt. Since this examination the gates have been in operation for some eighteen months and, as far as the Author knows, no further examination has been made, showing that the silting problem, so far as Dover is concerned, is not a serious one. No case is known to

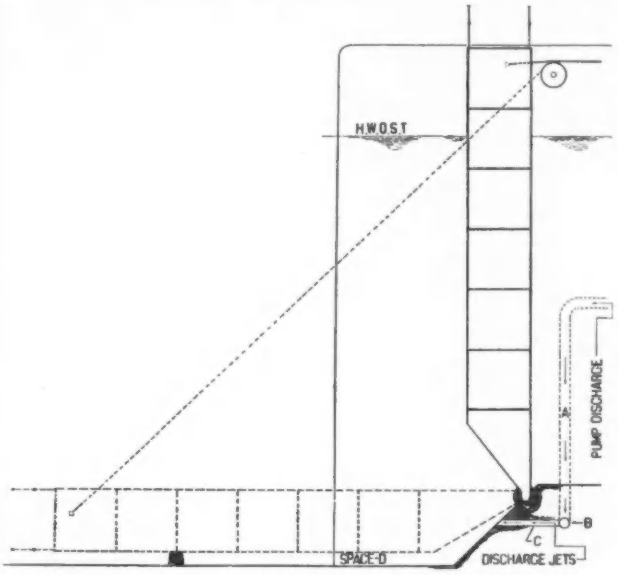


Fig. 19

the Author of trouble having been experienced through a gate not lowering sufficiently and, because of this, fouling a vessel; neither does he know of a chance obstruction having got under a gate and caused trouble.

Mr. Baxter has to some extent answered Mr. Bruce Ball's question about the Austin gear, and a full description of it will be found in Mr. Austin's paper.* In essence, as applied to a Box gate, the Austin equipment for Dover consists of two dynamos and an exciter in the pump-house, driven by an A.C. motor, two special motors (one for each winch) and the controls, which are mounted in a cabin alongside the dock entrance. The armatures of the dynamos are coupled direct to the motor armatures. The motors have constant fields, but the dynamo fields are controlled by the operator to vary the motor output as required. Stalling of the motors is given automatically by their special characteristics combined with graded air gaps, the stalling torque varying with the position of the controller.

In answer to Mr. Prior, it may be said that, before being dispatched to the site, the steelwork of the gates was given one coat of red-lead paint. The site painting consisted of two coats of tar applied hot to the outside and inside of the gates. The Author has not much information as to the period of time the gates are left in place without painting of the under-water portion. The dock side face of the gate is accessible at any time for cleaning and painting, and also the outside or sea face down to low-water level, but the gate must be removed for painting below water level. The Author knows of gates that have been in place for 15 years and longer without having been removed for painting, and of sill castings that have been found in excellent condition after a similar period.

Mr. Baxter's suggestion that the clapping faces might be built inclined instead of vertical has been considered, and will quite likely be tried on a future gate.

It is not possible to separate the cost of the Dover gates from that of the pontoon, as they were treated as one contract. When the estimate for this work was being prepared, a comparison was made between the cost of double-leaf and Box gates, and showed that the Box gates were the cheaper. It is impossible to make a straight comparison between various forms of gate without knowing the site conditions. In certain circumstances the savings in favour of a Box gate might be very considerable.

An automatic indicator is provided at Dover, and shows the position of the gate during the whole of the opening and closing operation. The clapping face on the pontoon is formed by means of machined steel flats attached to the cheeks of the pontoon. Two greenheart timbers form the clapping face on the gate itself. An almost perfect watertight job can be obtained, and it is not necessary to use rubber to achieve it, but in certain circumstances rubber strips might be introduced with advantage.

* Trans. I.E.S., vol. 68, 1924-25, p. 103.

Bombay Port Trust

Excerpts from Administration Report, 1937-38

The result of the year's working was a surplus of Rs. 23.58 lakhs on General Account, as compared with a surplus of Rs. 14.74 lakhs last year. This satisfactory result was achieved mainly by a substantial increase in revenue and partly by reduction in expenditure. The increase in earnings, viz., Rs. 7.61 lakhs, occurred mainly under wharfage fees at the docks and bunders, ground and shed rents at the docks, and rents realised from leaseholds and monthly tenancies. This increase has occurred in spite of a decrease of Rs. 4 lakhs in the receipts under surtax owing to its reduction from 12½ per cent. to 8⅓ per cent. with effect from 1st April, 1937. The increase in the traffic handled at the docks and bunders was mainly under imports, viz., petrol, cotton, grain (rice and wheat), glassware, iron and steel, kerosene oil, oilmanstores, paper, oils vegetable, timber and twist and yarn. On the other hand, there was a net reduction in exports, mainly owing to heavy decreases under raw cotton and groundnuts.

The net reduction in expenditure, as compared with last year, was slightly over Rs. 1 lakh; this would have been over Rs. 3 lakhs, had not the contribution from revenue for special repairs and renewals been increased from Rs. 3 lakhs in the previous year to Rs. 5 lakhs in 1937-38.

After transferring to it the year's surplus and the special receipt of Rs. 5.40 lakhs on account of General Tax refunded by the Municipality for the years 1934-37, in consequence of the revised assessment for the quinquennium 1934-39, the Revenue Reserve Fund stands at Rs. 97.95 lakhs, the actual market value as at 1st April, 1938, being Rs. 95.98 lakhs.

The total net tonnage of vessels arriving at the port was 7,013,803, comprising 3,135 steamers and motor-ships, of 6,135,099 tons, and 49,720 sailing vessels, of 878,704 tons, against 6,735,971 tons net in 1936, comprising 3,464 steamers and motor-ships, of 6,115,742 tons, and 36,535 sailing vessels, of 620,229 tons.

The cargo handled at the docks and bunders amounted to 5,532,000 tons, an increase of 72,000 tons, as compared with the volume of the previous year. Imports accounted for about 58 per cent. and exports 42 per cent. of the total tonnage. The increase in tonnage was equivalent to 1.3 per cent. Imports increased by 7 per cent., while exports decreased by 5.6 per cent.

Improvements at Ballard Pier

The increase in the size of ocean-going liners making use of Ballard Pier has resulted in a considerable increase in the number of passengers per vessel, and the accommodation provided for this purpose was found inadequate. The Trustees accordingly sanctioned a scheme for alterations and improvements, whereby the accommodation has been increased very considerably by an extension on the west side of the baggage hall, the whole of which can now be used for the stacking of baggage. The Customs hall has been re-constructed with enhanced space. A marble counter has been built in the centre of the hall for the passing of baggage forms and the payment of Customs and Port Trust dues. Improved roadway lighting and the provision of a car park are some of the other improvements.

The foreign inward and outward traffic on the Port Trust Railway aggregated 1,687,000 tons, as against 1,722,000 tons during 1936-37. An increase of 1,534 wagon-loads has, however, to be recorded in local traffic, principally under bonemeal, coal, china, clay, old iron and oil-cakes.

The report is signed by G. E. Bennett, M.Sc., M.Inst.C.E., Chairman.

The Ribble Navigation

Review

A History of the Ribble Navigation from Preston to the Sea. By James Barron, M.Inst.C.E. 1939. Published by the Municipality of Preston: Office of the Town Clerk, Municipal Buildings, Preston. Lancs. Price, 21s. net

Cutting the first sod of River Diversion at Castle Hill

Reproduced by permission from A History of the Ribble Navigation

Formerly, for a period of 32 years, Engineer and General Superintendent of the Ribble Navigation, Mr. Barron has employed the leisure of his well-earned retirement from active duties in the compilation of an exhaustive account of the undertaking with which he has been so long associated. It is a monumental record, not only of the fortunes and vicissitudes of a great enterprise, begun, continued, and almost finally achieved in the face of many difficulties, but also of the life-work of the engineer who, with his predecessors, has faced and overcome these obstacles in an endeavour to make secure the place and standing of Preston as a sea-port.

The book itself is an imposing volume, which, with its data, photographs, plans and charts, will form a valuable work of reference for maritime engineers. It will rank as a classic on a level with Sir Joseph Broodbank's History of the Port of London.

In some respects there is an analogy, however slight, between the Port of Preston and the Port of Manchester. Both are situated at an appreciable distance from the open sea, and both have been dependent on artificial means to secure for themselves that access to deep water which was considered to be so essential to their prosperity as trading ports. But whereas Manchester lies entirely inland and is approachable only by a completely artificial waterway, Preston has had the advantage of being on the banks of a river which, whatever its limitations in regard to depth and navigability, offered at least a nucleus for development and a channel for treatment. Both towns tackled their problem in much the same way. Companies were formed and Parliamentary sanction was obtained to proceed with programmes of engineering operations, and while, perhaps, Manchester may be said to have attained the immediate object in view, Preston is still labouring to complete the course of treatment which is to crown its undertaking.

Mr. Barron, in his determination to carry out his enquiry in the most thorough manner, commences with a description of the physical features of the Ribble River, estuary and adjacent sea. We need not deal with the natural characteristics of the river basin beyond noting that the total area of water shed above Preston is almost precisely 500 square miles, and below Preston rather over 200 square miles; that the annual rainfall varies from 65-ins. at the source down to 35-ins. near the mouth, and that the river is tidal for about five miles above the dock entrance at Preston.

At one time, before the carrying out of improvements in the channel, there was a distinct tidal bore in the Ribble, 3-ft. or more in height, with a speed of some eight miles per hour. Its effects were rather dreaded, and boatmen on its approach preferred to get out of their boats for safety and to wait ashore until it had passed. Now, records Mr. Barron, there is no bore, and only on exceptionally high tides is the arrival of the flood in any way noticeable. Spring tides now reach the dock gates at three hours or more before high water, and neap tides at from four to four-and-a-half hours. The tidal flow is moderate during the period of navigation, and rarely exceeds two miles per hour, generally being about one mile per hour, under normal conditions.

The Estuary Channels

The instability of the estuary channels of the Ribble is no less marked than those of many other estuaries. From 1736, onwards, the charts indicate a constant state of flux. During the past 200 years the main channel has deviated all over the estuary. There have been north, south and central channels, separately or simultaneously, with permutations and combinations under the influence of winds, waves, tides and floods.

The Bog Hole and South Channel

One of the most prominent features of the Estuary was the South Channel, commonly known as the Bog Hole. This was a blind channel, possessing for a length of over a mile-and-a-half a depth of 30-ft. or more at low water, with a depression, at the Southport pier, some 54-ft. deep. At the seaward end, there was a bar with a depth at low water of a little less than a fathom. Such was its condition in the main up to 1890, when the Mersey Docks and Harbour Board commenced dredging operations on the Mersey Bar. The depositing ground for the dredged sand was on the seaward margin of Taylor's Bank in shallow water, but, as no appreciable diminution of depth of water supervened in the locality, it was evident that the material was dispersed by natural agencies and that it settled elsewhere. Mr. Barron concludes that it was a definite cause of the silting up of the Bog Hole, which commenced to be apparent about 1895. The fixation of responsibility was difficult, owing to the prevalence of so many varying conditions, but Mr. Barron states that on one occasion he caught the large 10,000-ton sand pump dredger, "Leviathan," in flagrante delicto, depositing her cargo at the first of a big spring tide, right in the Ribble indraught to the north of Formby Point. The matter is essentially controversial, and the alleged cause the subject of dispute, but the fact remains that the Bog Hole has disappeared. "At low water the channel is merely a drainage runway above low-water level, shallow and tortuous, and a man in thigh boots can wade across it nearly anywhere in its length, while from the pier-end northwards, a continuous bank of sand extends right up to the Penfold Channel."

Here we have yet another instance of the instability and fickleness of estuary channels, and a demonstration of the mysterious influence of unknown causes in producing momentous results.

The Ribble Companies

The actual development of the River Ribble for navigational purposes is bound up in the history of a succession of companies formed for the purpose. The first was constituted under an Act of 1806, and it continued to exist till 1838. The purview of this Company was very restricted, and its activities were confined to the provision of buoys and perches to mark the channel and some groynes. It was hampered by lack of sufficient funds, and the acquisition of reclaimed land did not come up to the expectations of the proprietors. The undertaking was allowed to languish until, in 1836, statutory authority was obtained for the second company, which was floated with a capital of £50,000 in 1,000 shares of £50 each. Its programme was based on a report provided by Messrs. Robert Stevenson & Son, of Edinburgh, recommending certain improvements for navigation, which involved important capital outlay. A barrier of red sandstone rock in the bed of the river was removed, and dredging appliances were set to work to improve the depth generally. Training walls were also begun.

The Ribble Navigation—continued

The results of these operations were satisfactory, and it was considered further desirable to provide wharfage facilities at Preston and a " mud dock " at Lytham to meet trading requirements. About the same time, the Corporation of Preston built the Victoria quays at Preston.

In **1853**, arising out of a question respecting the jurisdiction of the Chancellor and Council of the Duchy of Lancaster in relation to the Crown rights in the foreshore, resulting from land reclamation, it became necessary to procure another Act of Parliament, and the opportunity was taken to acquire further powers for extending the training walls and for dredging. This led to the dissolution of the second company and the formation of the third, which lasted from **1853** to **1883**. In **1861**, there was a proposal for making a dock in the river close to the town, but the plan was not proceeded with immediately. However, by the end of **1864**, traffic having grown to K.C.M.G., and Mr. (afterwards Sir) John Wolfe Barry. The recommendations of the Committee were accepted, approving the continuation and completion of the works in hand, and Mr. A. F. Fowler was appointed Resident Engineer to superintend the execution of the work.

The dock was opened with elaborate ceremony on the **25th June, 1892**, by H.R.H. the Duke of Edinburgh. Unfortunately, while the accommodation provided was excellent, the means of access were rather indifferent, and want of sufficient depth of water led to certain mishaps to shipping, involving legal actions, which, in their train, necessitated an extension of dredging operations in order to improve the navigable depth.

Certain administrative difficulties led at this time to the termination of Mr. Fowler's services and the appointment of Mr. James Barron to the position of Engineer and General Superintendent as from April 9th, **1901**.

Aerial View of Dock at Preston [*Reproduced by permission from A History of the Ribble Navigation*

upwards of **90,000** tons, the question was taken up by the Corporation, who conferred with the Company on the subject.

This marks a further stage in the development of the navigation due to the intervention of the Corporation, who had certain responsibilities, features of which it would take too long to enumerate; briefly, it may be said that in **1882**, the Town Council agreed to purchase the undertaking in order to carry on the river development in the interests of the Municipality.

In **1883**, parliamentary powers to construct a dock were obtained, and in **1884** plans for a **40**-acre dock with tidal basin, entrance locks, river diversion and contingent works were prepared and the tender of Mr. Thomas A. Walker for the construction of the dock was accepted. The first sod was cut on the **11th October, 1884**.

Modifications became necessary before the works were completed, and there was a Parliamentary enquiry in **1888**, resulting, in **1889**, in the appointment by the Board of Trade of a special commission to report on:—

(1) The practicability and probable cost of providing a navigable waterway between Preston and the open sea;
(2) As to maintaining and keeping the existing training walls;
(3) As to dredging;
(4) As to the course to be followed in regard to the dock and its equipment.

The members of the Commission were Rear-Admiral Sir George S. Nares, K.C.B., F.R.S., Sir Charles A. Hartley,

From this point forward, the history of the Ribble Navigation is concerned with a series of extensions of the training walls, Mr. Barron having been insistent in all his reports on the need for extending the walls to **16** miles below Preston. For particulars of these extensions, reference must be made to the History itself. Towards the end of May, **1933**, Mr. Barron reached the age for retirement, and although the Ribble Committee unanimously recommended that his services should be retained in a consultative capacity, the Council did not accept the recommendation. Mr. Barron was deprived of the privilege of continuing to be associated with the Ribble in the final stages of the formation of the training walls, although he had the satisfaction of knowing that the work, so far as he had carried it, had proved its value and serviceability, and that the completion of the undertaking was entrusted to Mr. A. H. Howarth, his former pupil and assistant. At the time of his retirement, the walls had been extended to a distance of rather over **14** miles below the town, and since that time the southern wall has reached a distance of **15½** miles.

It being impracticable, within available limits of space to recount all the vicissitudes of the undertaking, it must suffice to say that this carefully documented and detailed account of the operations connected with the development and improvement of the Ribble Navigation is admirably done, and will form an extremely useful source of reference for engineers engaged in similar undertakings.

There is a Foreword by the Chairman of the Ribble Committee, an Introduction by the Town Clerk of Preston, and a very full index.

*The Development of the Floating Pneumatic Grain Elevator**

By Dr. CARL A. E. MUELLER, V.D.I.; V.B.I.; H.T.G. (Brunswick)

(Continued from page 104)

Sacking-off

In the discussion of the London elevators it was shown how, with the exception of the "Thomas Wiles," all of them are provided with contrivances for the sacking of grain. Similarly, the elevators provided for the military during the War could sack-off the grain. It soon became apparent that this sacking seriously affected the attainment of a high output. Similar

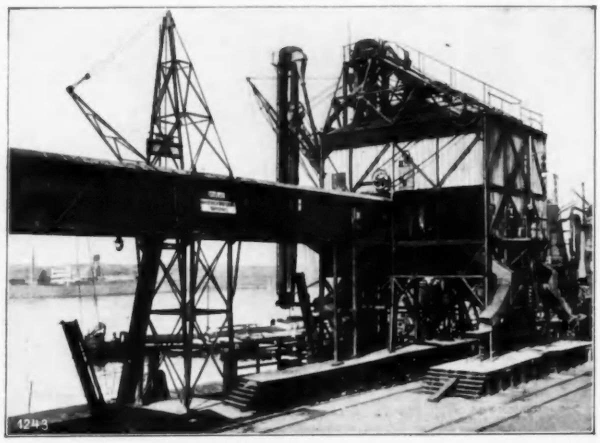


Fig. 28. Sacking Station of the Grain Elevator Company in Rotterdam

sacking apparatus had been built into some of the elevators supplied from Germany to Rotterdam and Antwerp, but it was soon seen that with high normal output the sacking-off could not be combined with the simultaneous handling of loose grain. These elevators were equipped with four sacking scales, with which one could weigh off hourly some 800 sacks with a total weight of 80 tons. Since, however, the standard elevators are able, in good berthing conditions, to unload 200 to 300 tons hourly, from 120 to 200 tons of grain must always be carried away loose. The filled sacks were, as a rule, loaded into carriers, sometimes but few in number, and therefore placed along the ends of the elevator, while the large boats for the reception of loose grain lay alongside. As these lighters must be frequently moved for uniform loading, and the small carriers, which only take a few sacks, must be changed after a short time, very appreciable disturbances occur in the operations.

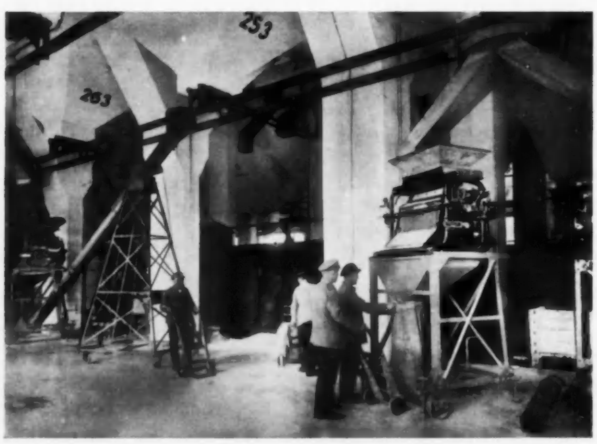


Fig. 29. Ramp Platform and Sacking Apparatus in Bremen Corn Exchange Warehouse

For these reasons, the sacking of the grain on elevators has been abandoned; and the process transferred to the quay where it is carried out quite independently of the unloading process.

The grain to be sacked is discharged from the elevator at the maximum rate into a self-trimming train of lighters, which are then unloaded on to the quay by means of a bucket conveyor to a sacking station, with a velocity corresponding to that of the sacking process.

The sacks can thence be loaded into river or canal boats, railway wagons or motor trucks.

The lighters serve, in this case, as stores. At many ports, large grain warehouses have been built, in which the grain can be sacked at high rates. Long slipways and approach roads for trucks, well bordered with loading ramps provide rapid facilities for removing the sacks.

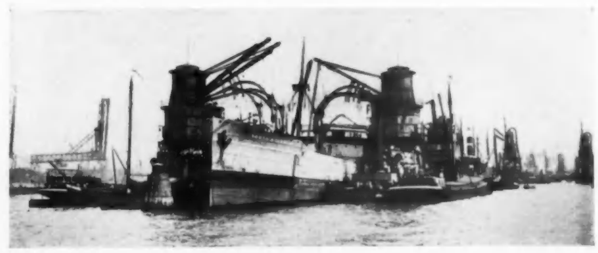


Fig. 30. The Independent Grain Elevator Company's "Van Berendonck" Elevator in Rotterdam

The Berendonck System

The grain elevators described so far work wholly by suction, excepting only the "Garry Owen," which has, in addition, a compression system for further transport of the grain. The constituent parts of the suction, such as the receiver, valve, etc., are comparatively heavy, and the higher they are, the more unfavourably they affect the stability of the elevator. M. Philippe van Berendonck, of Brussels, has tried an alternative method. In his patent the grain is blown out of the ship's hold into a container set up on the tower of an elevator, which container can be made much lighter than the receiver of a suction plant. No mechanism is required for the valving of the grain, since there is no difference of pressure between the air inside and outside the container. In this invention there is a suction nozzle at the mouth of the conveyor pipe, at which, according to the

Fig. 31. Grain working at Cherson with a Floating Pneumatic Grain Elevator

action of the pump, a variable suction through a separate pipe draws in the grain or compressed air is introduced. The grain is sucked into the nozzle, which is closed off from the conduction pipe by a flap-back valve, and it is then blown into the conveyor pipe, the suction being cut off by another flap valve. This produces a pulsating conveyance of the grain. In the year 1909-1911, tedious trials were made of two small elevators in Antwerp, which, however, led to the result that the pulsating conveyance was abandoned and pressure air only was led to the suction

* Translated from the German original in the Jahrbuch der Hafenbautechnischen Gelleschaft, Vol. XVI, published by Julius Springer, Berlin.

Development of the Floating Pneumatic Grain Elevator—continued

nozzle. This acted like an ejector, causing a column air to be set in motion in the pipe, by means of which the grain was drawn in and carried on into the conduction pipe.

Accordingly, return was made to a method which had already been patented by the Atmospheric Grain Elevator Co., in London, in 1892, but had been tried without success.

In the years 1912-1913 the Independent Grain Elevator Co., in Rotterdam, ordered four van Berendonck elevators after they had taken over the two already working in Antwerp.

These elevators were also known in Rotterdam as "Randahxe" machines. A two-cylinder air pump, making 40 double strokes per minute, driven through gearing by a vertical triple expansion three-cylinder steam engine (150 r.p.m., developing 600 h.p.), served to produce the compressed air. From each end of each air pump cylinder an air pipe led to a nozzle, so that to each nozzle there were connected two pipes, whereby the handling of the nozzles was heavily handicapped. When the apparatus worked without disturbance in thick layers of grain, outputs of 300 tons per hour could be obtained. If, however, the grain was only in a thin layer, it would be blown out by the air pressure, sometimes even right up on to the deck. These elevators were in service in Rotterdam until 1922, when they laid up owing to their low efficiency.

Fig. 32. Grain Unloading in Stettin Harbour

The number of elevators built after the War for Continental harbours is but small, as the import of grain diminished instead of continuing to expand. The replacement of worn-out machines was the principal business. Accordingly, mention should be made of the large elevators built in 1922 and 1928 for the Nord Deutsche Lloyd to work in Bremerhaven, already described, which replaced those built in 1896 and 1899 (Fig. 10). The Hamburg-Amerika Line also replaced their three old elevators by two new ones in 1922.

In Antwerp three elevators, driven by Diesel engines, have been installed, and on account of their continual availability for work have shown an appreciable improvement over the other elevators there, which are steam-driven. Although some of the recent elevators in Antwerp and Rotterdam have been built in Holland, they contain all the features of the German type.

About 80 per cent. of all the floating pneumatic grain elevators in the world are the product of German works.

Fig. 33. Elevator of the Hamburg-American Line in Hamburg Harbour

German Port Grain Trade

On account of the changes in the grain trade in German seaports in the last 15 years, there is, in addition to import, local and export business, a supply both from the rivers of Central Germany to the Rhine, and of Czechoslovakian grain by way of Hamburg or Stettin for destinations abroad.

Whereas formerly there was only a discharge from ocean steamer to river boat or small coasting steamer, to-day grain is discharged from river boats into ocean steamers or large coasting vessels. As, in general, the discharge pipes of the standard elevators are not suitable for this purpose, high-lift bucket conveyors have been built into a number of the Hamburg elevators, by means of which the grain can be lifted to the desired heights.

"Elevator III," built in 1913 for the Nord Deutsche Lloyd, which had already been fitted with a high-lift bucket conveyor on account of the conditions prevailing at Bremerhaven at that time, was taken over some years ago by the Measurement Office of the Chamber of Industry and Commerce in Stettin, after extensive reconstruction. It serves now exclusively for loading into ocean-going ships grain coming down the River Oder.

Fig. 34. A Grain Elevator ordered for Russia, on acceptance trials at Hamburg

Latest Examples

The last of the series of floating pneumatic grain elevators are the two built in Germany in 1932 for the Russian Government. These elevators were intended for the harbour of Cherson.

The grain will usually be discharged from river boats into silos on shore. In order to be able to discharge the river boats uniformly in various positions, the elevators have been provided with two entirely independently working pneumatic conveyor plants, each of which has four suction trunks, so that the grain discharge can be undertaken at eight points. Each of the two machines is in a separate tower, and is able to handle 150 tons per hour, so that each floating conveyor has a total capacity of 300 tons. For the first time in a German floating grain conveyor, turbine pumps have been applied, although this type of machine has been often used for fixed or movable pneumatic conveyors on shore. It may be remembered that in 1916 the two London elevators, "Turbo I" and

Development of the Floating Pneumatic Grain Elevator—continued

" Turbo II," used turbine pumps for the first time, but the use of these machines was not repeated in the later elevators.

The turbine pump is driven by a Diesel engine through a closed gear box. According to the specification, the power consumption per ton (per hour) of grain unloaded must not exceed 1 h.p. In order to be able to discharge the grain as high as possible, whether for loading very large ocean-going vessels or to get the greatest possible reach when discharging ashore, a high-lifting bucket conveyor has been built into each tower.

It appears specially notable that the latest of the series is equipped with more than one tower, just as the first was. Apart from the first, the " Mark Lane I," which, indeed, had three towers, many of the London elevators and the early ones in Hamburg and Bremen had two towers. It was believed then to be expedient to discharge an ocean-going vessel from at least two hatches, but the fact was overlooked that the distance between the hatches varies greatly, so that the two towers could rarely be utilised fully. Therefore all later elevators, as will be seen from the previous description, were provided with only one tower. If it is wished to discharge a ship uniformly, there are, as a rule, sufficient elevators available, so that four or even five of these machines can lay alongside the ship, as may be seen in several of the attached views. In the Russian elevators, the conditions are quite otherwise; they deal with the discharge from boats, the cargoes of which must be removed as uniformly as possible along their length, so as to avoid dangerous bending stresses in the boats. For this reason, the distribution of the plant into two units, each having the usual maximum number of four suction trunks, was considered desirable.

Dr. Mueller desires to express his acknowledgments to the Port of London Authority, Messrs. Henry Simon, Ltd., Messrs. Spencer (Melksham), Ltd., and The East Ferry Crane & Engineering Co., Ltd., for assistance kindly rendered and for material and photographs supplied in connection with the preparation of the article.

Attention has been directed by Messrs. Henry Simon, Ltd., of Cheadle Heath, Stockport, to the fact that Figs. 18, 19, 21, 23 and 24 on page 103 of the February issue of this Journal are photographs of plant designed and constructed by them, and that these illustrations are the firm's copyright. We have pleasure in making this acknowledgment.

Recent Developments at the Port of Montreal

From a report appearing in the Canadian Press, the following information has been gathered relative to the recent activities of the Port of Montreal. No spectacular development is reported, but both in numbers and tonnage, arrivals in 1938 showed an increase over 1937, and all classes of vessels shared in the increase—ocean, coasting and inland. There was an increase of 4 per cent. in the number of ocean vessels, 2 per cent. in coasting and 17 per cent. in inland. The net registered tonnage of all ships visiting the port in 1938 exceeded that of 1937 by about 4½ per cent.

The total cargo tonnage, inward and outward, handled during 1938 was approximately 16,500,000 tons, compared with 16,369,634 tons in 1937. There is a remarkable similarity between the tonnage figures of 1938 and those of 1937, not only in the totals for the year but in the distribution as between inward and outward tonnages, and also in the quantities month by month throughout the season. Inward tonnage in 1938 was 61.3 per cent., and outward 38.7 per cent. of the total; in 1937 inward was 61.5 per cent., and outward 38.5 per cent.

The total handling of coal in 1938 was in excess of 3,400,000 tons—108,000 tons more than in 1937.

Grain still holds first place in outward cargo movement. The total deliveries from the National Harbour Board's elevators were expected to reach 100,000,000 bushels, an increase of about 7,400,000 bushels over 1937. About 90,300,000 bushels were exported to 13 European countries. Over 60 per cent. of the total grain exports came to the United Kingdom.

The total number of passengers of all classes landed and embarked at Montreal in 1938 was about 162,400, or 2,600 less than in 1937. This traffic, which in the early part of the season was slightly ahead of 1937, reached its peak in the month of August, after which it suffered a setback, the result undoubtedly of the political crisis in Europe.

An event of outstanding importance to shipping using the harbour was the announcement by the Department of Transport on September 23rd, 1938, that it was in a position to authorise a clear depth for shipping of 32-ft. 6-in. (low-water elevation of 1897) in the main ship channel between Quebec and Montreal, this depth corresponding to that already authorised for the dredged section of the North Channel below Quebec. This increases by 2½-ft. the depth of water available to shipping at low-water stage, and marks another step in the development of the port.

The St. Lawrence Channel

This announcement directs attention to the main artery feeding Montreal, and suggests that a short historical review of the development of the ship channel between this port and the sea might be opportune. Interest in the question was stirring as long as 112 years ago, for it is recorded that in 1826 the Legislative Assembly of Lower Canada took up as a matter of public importance the necessary improvement of the natural channel of the river. The maximum draft for navigation at low water was then governed by the depth of water on the flats of Lake St. Peter, which was 10½-ft. Nothing appears to have been done until 1844, when dredging, under the direction of The Board of Works of Canada, was started in Lake St. Peter.

The work of improving the ship channel was transferred to the Harbour Commissioners of Montreal in 1850. Excavation up to this point was on a straight channel through St. Francois Bank, but this was abandoned by the Harbour Commissioners, and in 1851 the deepening of the natural channel through Lake St. Peter was begun. As deepening progressed, other portions of the river had to be dealt with, and the work was extended to cover them. By 1853 the minimum depth of water was 16-ft., in 1859 it was 18-ft., in 1865 it was 20-ft., and in 1878 it was 22½-ft. It was not until 1882 that a channel, 25-ft. deep and 300-ft. wide, was completed from Cap a la Roche to Montreal. Vessels requiring this depth were obliged to wait for the tide below Cap a la Roche. A 27½-ft. channel was authorised in 1884, and was available in 1888, also by waiting below Cap a la Roche for the tide.

The Federal Government in 1888, by Act of Parliament, declared the ship channel a national work and transferred it from the Harbour Commissioners of Montreal to the Department of Public Works. This department carried on the work of improvement till 1904, when it was transferred to the Department of Marine. The merging of several departments (including Marine) in 1936, brought the ship channel under the Department of Transport.

An exceptional low water in 1897 led to its adoption as the fixed datum for minimum depths in the ship channel and Montreal Harbour. In 1899 a project was started to provide a 30-ft. channel on the new datum, and this was completed in 1910. That same year saw work started to deepen the channel to 35-ft., and it has now reached a point where a clear 32½-ft. at low water is available from Montreal to the sea.

Concurrently with the deepening of the ship channel, work in the harbour has been carried on with the new datum in mind. New wharf structures and major replacements of existing wharves and piers in recent years have been designed and constructed to provide berthing accommodation to the full depth of the ship channel.

Hartlepool Port and Harbour Commission

Financial Statement for 1938

At the annual meeting of the Hartlepool Port and Harbour Commission held early last month, it was reported that the accounts for 1938 showed a surplus on the year's working amounting to £1,281, compared with £4,402 in 1937. Receipts from harbour dues totalled £5,928, and from import and export tolls £7,364. The figures for 1937 were £7,054 and £8,367 respectively. Bank and other interests amounted to £1,532, and the total of the surplus funds of the Commission at the end of the year was £70,995, including the sum of £31,000 reserved for plant renewals.

Mr. J. W. Goldson, the Engineer and Secretary to the Commission, reported that a good minimum depth was maintained in Hartlepool Channel throughout the year. It was also stated that satisfactory progress had been made with the Government-assisted scheme for the strengthening and repair of part of the headland wall put in hand by the Hartlepool Corporation. It is anticipated this work will be completed within the next few months.

Obituary

The death is announced of Mr. Charles Sydney Page, who, until his retirement in 1935, was for nine years Chief Docks Manager at Cardiff for the Great Western Railway. Mr. Page began his career with the London and North-Eastern Railway Company at York, and was for some time personal clerk to the General Manager, the late Sir George Gibb. Later, he became District Superintendent at Hull, where he was responsible for the whole of the port traffic, not only as regards rail movement, but also loading and discharging operations. In 1920, he went to Cardiff as Assistant General Manager of the Cardiff Railway, which then owned the docks at the port. On the amalgamation of the South Wales docks and railways with the Great Western system in 1922, Mr. Page was made Assistant Docks Manager, and subsequently, Chief Docks Manager. He was a Member of the Institute of Transport.

1939

TD

ES
CE

S
EN

NG

ON

OF
LD

Y

00
AR

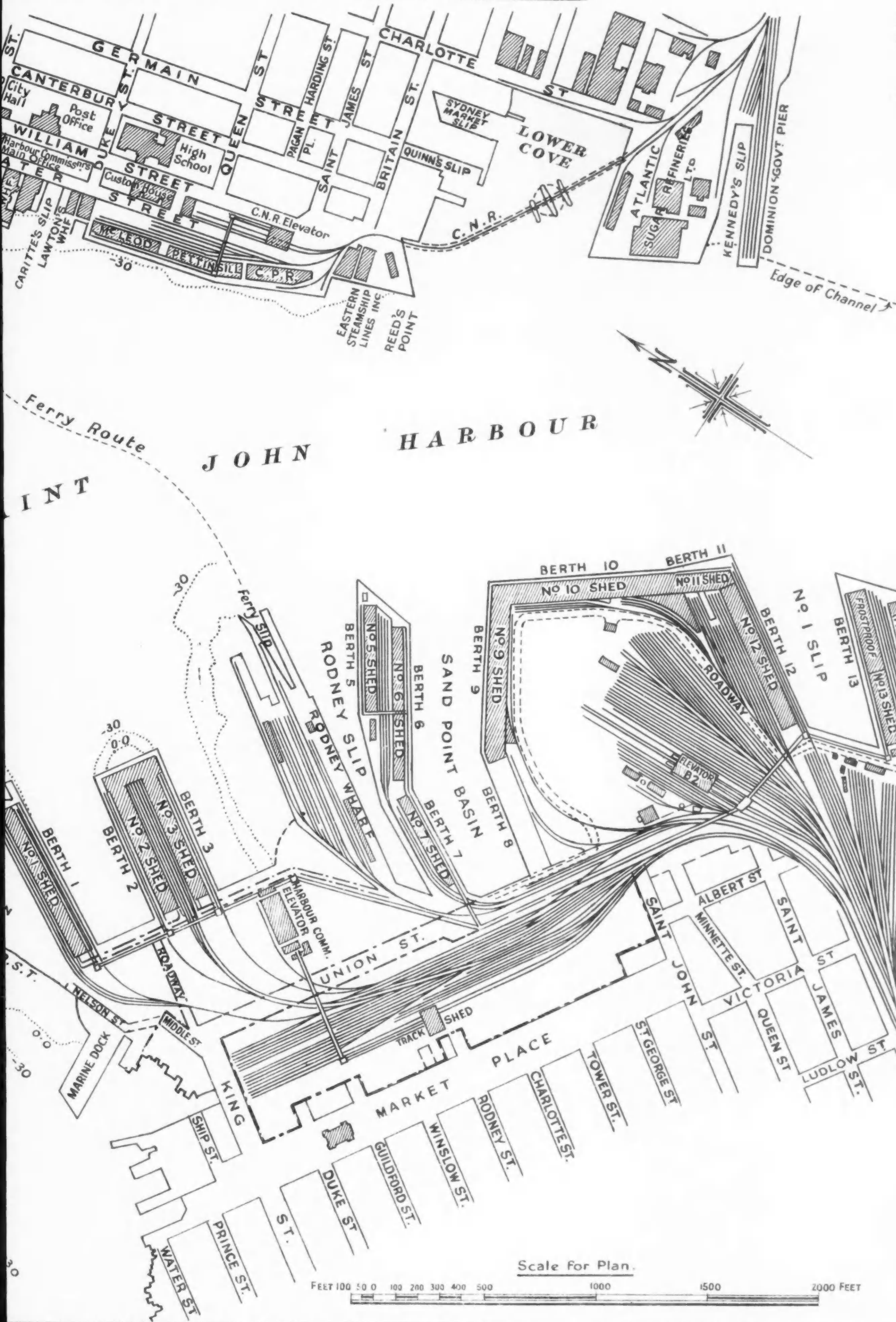
SAINT JOHN HARBOUR, NEW BRUNS

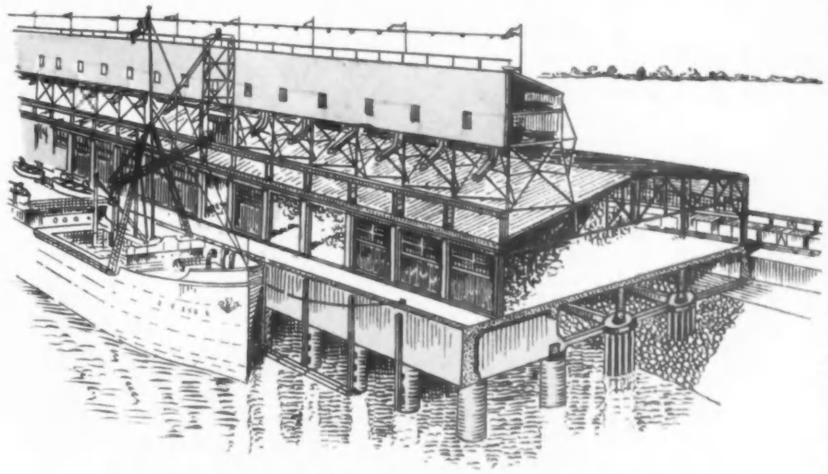
UNDER THE JURISDICTION OF THE NATIONAL HARBOUR BOARD OF CANADA.

WARD & FOXLOW, LITH. HARCOURT STREET, MARYLEBONE W.

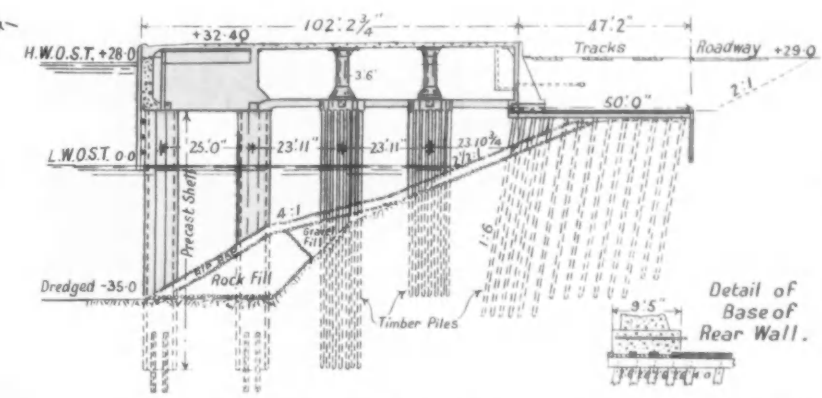
HARBOUR, NEW BRUNSWICK.

N OF THE NATIONAL HARBOUR BOARD OF CANADA.

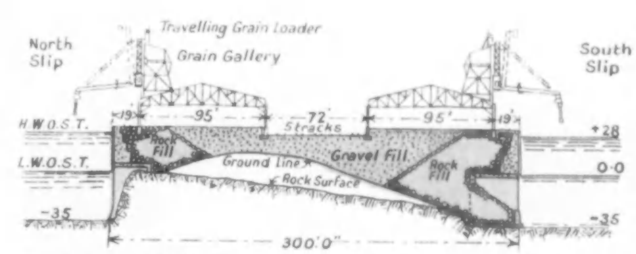




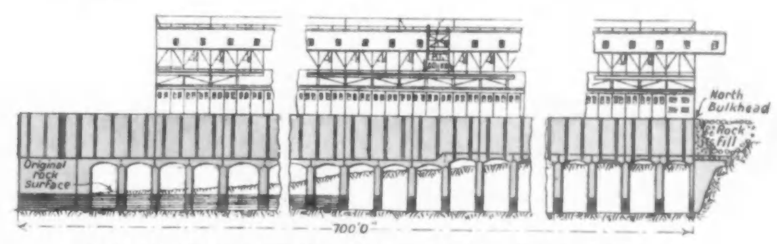
PERSPECTIVE VIEW – BERTHS 8-9-10-11.



TYPICAL SECTION – MAIN STRUCTURE – BERTHS 8-9-10-11.



TYPICAL CROSS SECTION – PIER & SHEDS 2 & 3.



ELEVATION – NORTH WALL – PIER & SHEDS 2 & 3.

WARD & FOXLOW, LITH. HARCOURT STREET, MARYLEBONE W.

Notes of the Month

New Lithuanian Port.

The Lithuanian Government have decided to take steps to develop the fishing harbour of Shventai into a port capable of accommodating overseas shipping.

Extension of Kaiserhafen II, Bremerhaven.

Owing to harbour lands having to be used for other purposes, it has become necessary to lengthen the Kaiserhafen II at Bremerhaven, by 700 metres (2,296-ft.). The work, which is expected to cost approximately 4,000,000 Rm, was commenced a short time ago, and will take about two years to complete.

Southampton Air Base Facilities.

At a private meeting of the Southampton Harbour Board held recently, it is understood the members unanimously approved a Bill which is being promoted at the request of the Air Ministry in connection with the scheme to provide facilities for a marine air base in Southampton Water. The Bill will now be considered by various Government departments before coming before Parliament.

New Quay to be Constructed at Tyne Dock.

The Tyne Improvement Commission having decided as previously announced, to proceed with the construction of an 800-ft. quay at the north-west corner of the dock, a contract has been placed with Messrs. Brims & Co., Ltd., Civil Engineers, Newcastle. The work, which will take about 18 months to complete, will give employment to a considerable number of men. The new quay will be used primarily for timber, and will also be adaptable for ore discharge.

Dock Extension at Port of Bristol.

Work will shortly be commenced on the extension of the Royal Edward Dock at Avonmouth, a contract for a portion of the proposed improvements having been assigned to Messrs. Charles Brand & Son, Ltd., of London. The work will include excavation, construction of wharves, shed foundations, two timber jetties for mooring barges and other incidental work. It is expected that this section of the extension will take about two years to complete.

Ship Channel Widening at Port of Stockton.

The United States Federal Government are embarking on a channel widening project for the approach to the Port of Stockton, California. The estimated expenditure is $440,000, which will include portions of the Stockton inland ship channel between Stockton and Pittsburg, California. The dredging programme provides for an increase in the bottom width of the channel from a minimum of 150-ft. to 225-ft. The work is expected to be completed in 1940.

Canadian Shipping in 1938.

The registered net tonnage of 118,119 vessels arriving at Canadian ports during the fiscal year ended March 31st, 1938, was 90,074,889 tons, of which 75,537 vessels were entered as coastwise, 26,407 sea-going and 16,175 between Canada and the United States on lakes and rivers. The tonnage of cargo brought in by sea-going vessels totalled 12,698,849 tons, while the outbound cargoes aggregated 13,882,060 tons. The number of vessels built in Canada during the year was 13,074, with a registered net tonnage of 46,944.

Automatic Light for East Coast of Ceylon.

In view of the fact that the position of the eastern coast of Ceylon between the Little Basses and Batticaloa—a distance of approximately 80 miles—is exceedingly dangerous to shipping, it is proposed to instal an automatic light at Sangamankanda Point. At the moment, there is no lighthouse serving this area, and during the last 60 years six steamers have been wrecked in the neighbourhood of the Komari Reef, where the currents are notoriously treacherous. It is understood that the light will be an "Aga" pattern, similar to the one installed at Point Pedro.

Dues on Coal Imports at Dover.

The Dover Corporation has lodged a petition at the House of Commons against the Dover Coal Dues (Abolition) Bill. At the same time, in support of the Bill, the Council of the Chamber of Shipping has unanimously passed the following resolution:—"That this Council of the Chamber of Shipping, representative of all classes of British shipping, expresses strong support for the Bill promoted by the Dover Gas Company and others, and now before Parliament, for the abolition of the dues of 1s. 7d. per ton which the Dover Corporation levies on coal imported into the town by sea, and which are levied for municipal and not port purposes, on the grounds that (1) the levying of the dues, other than for port purposes, is unsound in principle, and (2) the dues discriminate gravely against coastal shipping in favour of rail and road transport."

New Graving Dock at Brest.

The French Minister of Marine has given orders for the construction of a special dock for shipbuilding purposes at Brest Naval Yard. The dock is to have a length of 300 metres.

Canadian Canal Traffic in 1938.

Freight tonnage through the Canadian canals during the 1938 season of navigation totalled 24,640,188 tons, being an increase of 1,289,188 tons, as compared with 1937. The number of vessels passing through the canal system was 27,738, having a registered tonnage of 22,736,246 tons, whilst the passengers transported totalled 50,140.

Coast Protection Bill.

The Tees Conservancy Commission recently decided to oppose the Coast Protection Bill on the ground that it will interfere with the Commission's dredging activities. The Chairman pointed out that if application for a local inquiry was granted the work of the Commission would be impeded while awaiting the decision of that inquiry.

Trade Returns for Estonia.

The total tonnage of vessels passing through Estonian ports during 1938 (including coastal shipping) was 3,097,000 tons, compared with 3,012,000 tons in 1937. The total volume of goods carried inwards and outwards was 1,013,000 tons, a decrease of 98,000 tons, or 8.7%, compared with 1937. The decrease is mainly attributed to a recession in export of timber.

Harbour Developments at Tokio.

A further enlargement of the Port of Tokio is now being carried out by the Municipal Council. When the expansion scheme is completed, 80 ships of up to 6,000 tons each will be able to dock in the port at a time. Port construction at Tokio was commenced in 1880, and a further expansion scheme was put in hand in 1931. The total area of the port at present is about 30,000 acres, and to date, nearly £5,000,000 has been spent on docking facilities.

New Oil Installations at Havre.

It is reported that the Havre Port Authority is contemplating the installation of additional oil tanks at Tancarville. The tanks, which are expected to have a capacity of about 300,000 tons, will be dug in a cliff and will be practically bomb-proof. They will be connected by pipe line with the Havre installations and, possibly, with the refineries at the Seine Estuary. Berths will be provided for tank-lighters in the Tancarville Canal.

Paisley Harbour Proposal.

A survey of the dock and harbour facilities at Paisley is to be made by the Town Council. The River Cart, a tributary of the Clyde, is becoming badly silted, and the old harbour is practically derelict. Messrs. Fleming and Ferguson, Ltd., the local shipbuilding firm, are pressing the authorities to do something towards improving the river, and have suggested dredging and harbour improvement. It is estimated that three months' dredging would make the river navigable for ships up to 4,000 tons. The matter is receiving consideration.

Proposed Harbour Extensions at La Guaira.

Improvements to the Port of La Guaira are under consideration by the Venezuelan Government, and it is expected that tenders for the work will be opened in the near future. The details of the scheme are as follows:—(a) An extension of about 500 metres to the present main breakwater; (b) a concrete mole, 848 metres long, along the south of the harbour; the space behind the mole will be reclaimed and filled in to form a quay; (c) a breakwater to the westward, 540 metres long (similar to the present one to the northward), with a jetty to the eastward, 263 metres long; (d) an inner basin to the west of the harbour for fishing craft; (e) an inner basin to the east of the harbour for launches; (f) dredging of the port; and (g) tracks for cranes and wagons and other minor work.

Third Reading of Maryport Harbour Bill.

The Bill, promoted by the Maryport Harbour Commissioners to make provision for their finances, has recently passed the House of Commons Unopposed Bills Committee, and is to be presented to Parliament for its third reading. The harbour undertaking is a statutory one, and it has been the practice of the Commissioners to raise finances by means of mortgages, but owing to the trade depression of recent years, the closing of collieries and competition from the new docks at Workington, revenues have been steadily diminishing. In order to prevent the harbour from closing completely, the Special Area Commissioners are making grants to enable essential work to be put in hand to recondition the harbour, the work having become necessary owing to a number of developments in Cumberland which are conditional on the harbour being restored.

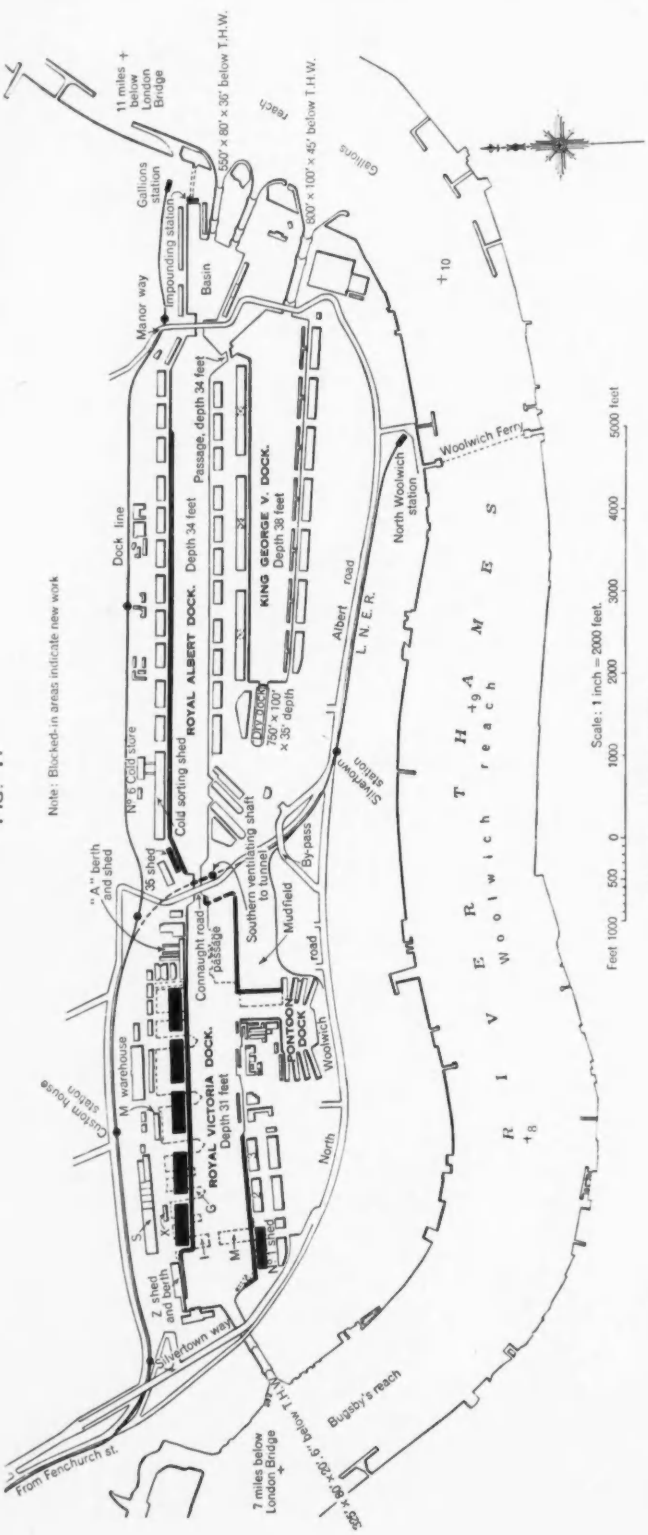
Improvements at the Royal Docks, Port of London Authority*

By RALPH ROBSON LIDDELL, M.Inst.C.E.

Historical

THE Royal Docks (Fig. 1) consist of the Victoria Dock opened in 1855, the Royal Albert Dock opened in 1880, and the King George V Dock opened in 1921, each new dock being connected with the older by a passage, thus forming an enclosed water area of 247 acres within a dock estate of 1,102 acres. The Victoria Dock entrance is seven miles below London Bridge, the distance through to the Albert Dock entrances at Gallions Reach is three miles, and the latter is about 16 miles above Gravesend, where vessels have to stop for H.M. Customs, the Port Medical Officer, and to change pilots.

FIG. 1.



PLAN OF ROYAL DOCKS.

In order to appreciate the scope of the works and improvements carried out by the Port Authority, it is necessary to give some particulars of the two older docks and the conditions which obtained when they were taken over in 1909.

The construction of the Victoria Dock was described in a Paper to The Institution by Mr. W. J. Kingsbury, Assoc. Inst. C.E.†; the main features being a main dock of 74 acres and a tidal basin of 16 acres, all cut out of the marsh land, the surface of which was about 8-ft. 6-in. below Trinity High Water and protected by river banks to 5-ft. above that datum. On the north side four solid piers were built, each 500-ft. long by 140-ft. wide, and containing a two-storey brick warehouse 80-ft. wide with vaults. Later, several intermediate timber jetties, about 400-ft. long by 80-ft. wide, and considerable accommodation in the way of sheds, warehouses, granaries, and refrigerating chambers, were added.

The length of quays available for berths was 11,740-ft. and in addition, 3,030 lin. ft. was leased to various firms for flour mills, coal wharves, etc.

The depth of this dock and basin and the inner sill of the lock was 25-ft. 6-in. below Trinity High Water, the lock itself being 325-ft. long by 80-ft. wide, with a depth of 28-ft. below Trinity High Water. As the depth of water over the sill at neap tides was 24-ft., any vessel requiring more than that had to wait for spring tides. These conditions prevailed for 25 years, until the opening of the Royal Albert Dock, when steam pumps were installed at the east end of the new dock to maintain the water of both docks at the level of Trinity High Water.

The Royal Albert Dock, completed in 1880, consisted of a main dock of 73 acres, 6,600-ft. long, with a uniform width of 490-ft. and a depth of 27-ft. below the impounded level of Trinity High Water; a passage at Manor Way, 80-ft. wide and 27-ft. 3-in. deep; and a basin of 14 acres leading to a lock 550-ft. long by 80-ft. wide and 30-ft. deep below Trinity High Water. The depths at the passage and the lock were reduced by the inverts rising 4-ft. 6-in. to the side walls, which corresponds to 3-ft. for ships of 70-ft. beam. The limited depth no doubt led to the construction and completion of the lower deck in 1886, with a depth of 36-ft. below Trinity High Water, again less 3-ft. for a 70-ft. beam ship. The Royal Albert Dock was also provided with two dry docks, the larger being 500-ft. long and 62-ft. 9-in. wide at the springing of the invert. The total length of quay available for berths was 15,160 lin. ft.

An obligation in the construction of the Royal Albert Dock was to transfer the North Woolwich branch railway line of the Great Eastern Railway from the surface at Connaught Road to twin tunnels under the new 80-ft. wide passage. The distance to the intrados of the tunnel arches was fixed at 30-ft., and the depth over invert of the new passage at 25-ft. 6-in., both below Trinity High Water.

In 1902 a Royal Commission reporting on the condition of the river and docks stated:—

"It is obvious that the Dock Companies could gain no advantage in deepening the entrances of their docks if the river remained unimproved, because, as is well known, large ships, with the river in its present condition, can only approach or leave the docks at or near the time of high-water, and at this time of tide the locks, although perhaps susceptible of some improvement, are not conspicuously inferior in depth to that of the channel of the river at such times."

The limiting depth of water in the river at low-water spring tides was 16-ft. above and 25-ft. below Gravesend.

The Royal Commission recommended that a channel of not less than 30-ft. in depth at low-water spring tides should be made from the Nore to the entrance of the Royal Albert Dock, at an estimated cost of £2,500,000, and improvement and extension of the docks at an estimated cost of £4,500,000; a total sum of £7,000,000 to be raised and expended within 10 years.

The above represents the obligations taken over by the Port of London Authority when constituted in April, 1909.

* Paper read before the Institution of Civil Engineers, November 29th, 1938. Reproduced from the Institution Journal by kind permission of the Council.

† "Description of the Entrance, Entrance Lock, and Jetty Walls of the Victoria (London) Docks; with a detailed account of the Wrought-Iron Gates and Caisson, and remarks upon the form adopted in their Construction." Minutes of Proceedings Inst. C.E., vol. xviii (1858-59), p. 445.

Improvements at the Royal Docks, Port of London Authority—continued

Works Previously Undertaken by the Port of London Authority

Under the direction of their first Chief Engineer, the late Sir Frederick Palmer, Past-President Inst. C.E., the plant necessary for deepening the river was acquired and put to work, designs of the dock extension south of the Albert Dock were prepared, and other urgent works were started.

At the Royal Docks the first of these was the construction of a new intake-culvert and impounding station, and the installation therein of electric pumps to replace the steam pumps and to raise and maintain the water in the Victoria and Albert Docks to the increased height of 30-ins. above Trinity High Water. This was completed in 1911, at a cost of £44,500. The culvert, 13-ft. 4-in. wide and 14-ft. 3-in. deep, is 400-ft. long between the 30-ft. wide bellmouth at the riverside and the sump (80-ft. long by 21-ft. wide). The invert is level throughout at 23-ft. 6-in. below impounded level, or 3-in. above low-water spring tides.

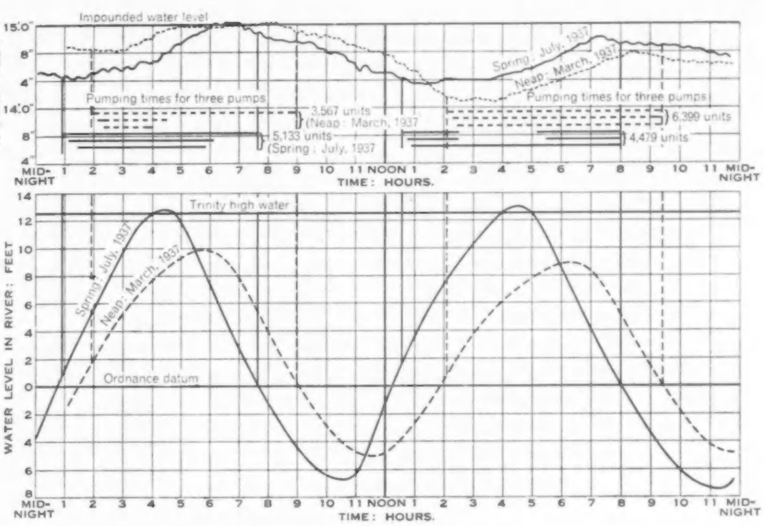


Fig. 2. Variation of Dock and River Levels

The three pumps were designed to discharge 15,000 cu. ft. per minute each, during a period of three hours before to three hours after high water against a head varying from 15-ft. to 2-ft. 6-in. Each pump has one 70-in. suction and two 50-in. discharge branches connected together into one 70-in. outlet. The suction and discharge pipes are each bellmouthed to 95-in. Each main pump is driven by a 2-phase 50-cycle 6,000-volt slip-ring induction motor, designed to develop 430 brake horse-power at 195 revolutions per minute.

The diagram (Fig. 2), recorded electrically, shows the variation of the dock and river levels during 24 hours of neap tides in March, 1937, and spring tides in July of the same year. This diagram also shows the starting and stopping times of each pump and the total units used during the tides.

In 1912, work was commenced on the major improvement, namely, the construction of the King George V Dock, which was described in a Paper to The Institution by Mr. Asa Binns, M. Inst. C.E.*

This dock, 65 acres in extent, with 38-ft. depth of water (Fig. 1) was joined to the Albert Dock by a passage, 100-ft. wide and 34-ft. deep, which, since 1921, has made access to the older docks possible for vessels up to 650-ft. in length and, as the depth over the sills of the new lock is 45-ft. below Trinity High Water, the period over which locking was possible for deep-draughted vessels using those docks was considerably increased.

At the same time a contract was placed for widening the western dry dock from 56-ft. 6-in. to 80-ft., and for lengthening it from 408-ft. 6-in. to 575-ft.; a new steel rectangular caisson was also built, inside the dock. The old hardwood keel-blocks, 42-in. high, were replaced by cast-iron wedge blocks with greenheart caps and, at the shipowners' request, the height was increased to 54-ins. Thus, although the depth over the sill had been increased to 25-ft. by impounding, the depth over the keel-blocks was limited to 23-ft. 6-in. This work was completed in July, 1914, at a cost of £67,000.

The steam-pumping plant serving the two dry docks was replaced in 1917 by two 34-in. Tangye pumps, driven by two 220 brake horse-power, 250-volt synchronous motors, at a speed of 250 revolutions per minute, and capable of de-watering the enlarged dock in three hours. In 1920, four sets of motor-driven air-compressors were installed for 100 tools at 100 lb. per sq. in. pressure, and a 25-ton electric travelling crane and track provided for each dock.

On the north quay of the Albert Dock and basin a crane track of 13-ft. 6-in. gauge founded on 15-in. "Simplex" piles at 16-ft. centres, with an electric conduit, was constructed for a length of 7,020-ft.; and by 1916, forty-three new electric cranes of three tons lifting capacity at 60 to 65-ft. radius had replaced the 30-cwt. 40-ft. radius hydraulic cranes at a cost of £85,000.

At the west end of the above quay three of the transit sheds were replaced by a two-storey reinforced concrete shed 1,100-ft. long by 110-ft. wide on the upper or cold-sorting floor and 123-ft. 6-in. wide on the quay or transit floor. This building is connected by two steel conveyor-bridges across the road and railways, to the top floor of a new cold store (No. 6), a six-storey reinforced-concrete building divided vertically into four sections, insulated throughout by two layers of 3-in. cork slabs and arranged with air-ducts for circulating cold air in any

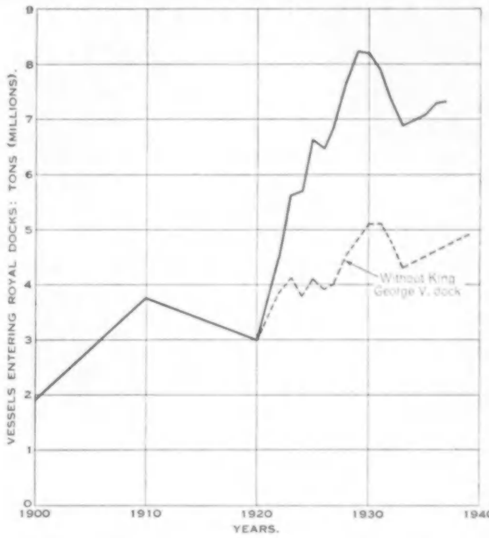


Fig. 3. Tonnage of Vessels using Royal Docks

section. The cold store was completed in 1918 and the cold sorting floor in 1920, at a total cost of about £450,000, and increased the cold-storage accommodation (15° F. to 18° F.) at these docks from 2 to 4 million cu. ft., representing a holding capacity of nearly one million carcases of mutton.

In 1918 the exchange sidings along the landward side of the Royal Victoria Dock were remodelled and extended westward; sixty-four new turnouts and 6,000 yds. of sidings being laid down in 75-lb. per yd. flat-bottom rails, this being the standard section adopted in the docks.

In 1920, the accommodation for the warehousing of tobacco was increased by 580,000 cu. ft. by the erection of a single-storey brickwork building, wherein American tobacco in hogsheads, weighing about 10 cwt., are handled and stored by means of electric overhead travelling-cranes, which pile the hogsheads in tiers five high. This was followed by the completion in 1922 of a six-storey building (shown as "M" in Fig. 1) built of reinforced concrete with brick-panel walls and concrete floors and equipped with two 2-ton electric lifts, hydraulic baling presses, and nine 30-cwt. electric wall-cranes for receiving the tobacco from craft alongside the new reinforced concrete quay, or for delivering this material to rail and road vehicles on the landward side. This warehouse added 1½ million cu. ft. to the tobacco accommodation, at a cost, inclusive of quay, railways, etc., of £230,000.

The success of the storage of hogsheads five tiers high led to the reconstruction on similar lines of two old tobacco warehouses in 1928.

To provide for the rapid development of the chilled-meat trade which had been located at Shed No. 35, Royal Albert Dock (Fig. 1) since 1921, and the increase in size of the steamers engaged in the trade, a new reinforced-concrete quay, 600-ft. long, on cylinders, was constructed on the north side of the tidal basin of the Royal Victoria Dock and a new shed erected. This is equipped with 6,000-ft. of overhead mechanical runways on which the quarters of beef are hung and travel over automatic weighing machines to insulated road or rail vehicles waiting at any position along the 1,450 lin. ft. of covered-in loading platforms. This work was completed in 1926, at a cost of £146,000. The average quantity of meat discharged from the vessel arriving each week is about 3,800 tons.

To provide a second berth for this trade, 600 lin. ft. of the timber quay at the east end of the Royal Victoria Dock was reconstructed in reinforced concrete, and "A" Shed (Fig. 1)

* "The King George V Dock, London." Minutes of Proceedings Inst. C.E., vol. ccxvi (1922-23), Part II, p. 372.

Improvements at the Royal Docks, Port of London Authority—continued

was erected and equipped with runways, similar to the above, serving 1,500 lin. ft. of loading platforms. This work, which was completed in 1928, at a total cost of £123,000, involved the demolition of No. 2 cold store erected in 1890 for frozen meat.

In 1934 two more of the timber-built cold stores —described in a Paper to The Institution by the late Mr. H. F. Donaldson, M. Inst. C.E.*—were demolished, No. 1 to provide space for 1,000 lin. ft. of covered platforms with motor-driven conveyor belts for the delivery of bananas from the quayside elevators to road and rail vehicles, and No. 3 for the erection of a single-storey reinforced concrete shed on " Vibro " piles, with a roof designed as a floor for future requirements. This shed provides a floor area of 40,000 sq. ft., with a height of 13-ft. 6-in. for the sorting and storage of oranges and other fruit, and has 500 lin. ft. of covered platforms for deliveries to road or rail vehicles. It was completed in 1935, at a cost of £66,000.

As the Port Authority, about this time, had under consideration further developments, it is interesting to note here that the capital already laid out on works at this group up to March, 1935, amounted, in round figures, to £6,000,000, which, added to the 1909 value of £8,000,000, brought the total capital value of the Royal Docks to £14,000,000.

The accompanying graph (Fig. 3) shows the rapid increase in the annual net registered tonnage of vessels entering these docks during the above period, and that even during the 1933 slump, the tonnage was about double the 1910 figure.

The size of the vessels using the docks was also increasing, and it was evident, by the number of vessels which had to lighten in the George and Albert Docks, before proceeding to their usual berths in the Albert and Victoria Docks, respectively, that draught had overtaken the extra depths provided in 1911 by impounding.

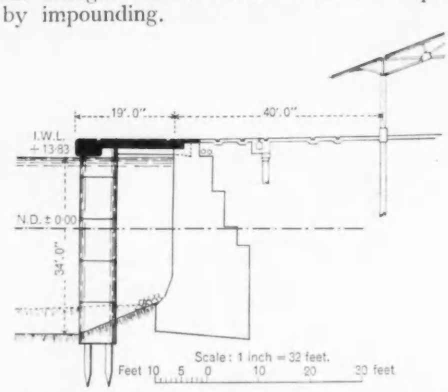


Fig. 4. Albert Dock: Section through North Quay

In consequence, the Port Authority decided to increase the depth of the Albert Docks by dredging from 29-ft. 6-in. to 34-ft., the latter being the depth in the passage from the George Dock; to construct a false quay at that depth along the greater part of the north quay of the Albert Dock; and, as a large and increasing proportion of the vessels using the port approach 29-ft. in draught on arrival, they also decided to undertake the deepening of the passage to the Victoria Dock to 31-ft., and to remodel the accommodation in that dock with an increase in depth to 31-ft., all under powers obtained by Act in 1935.

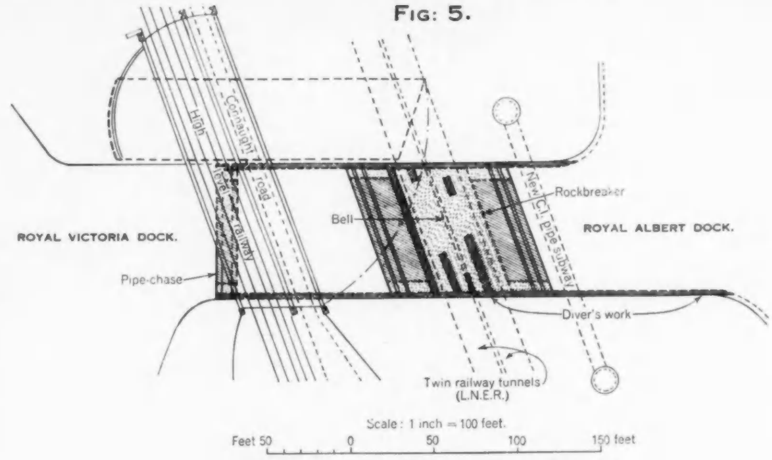
PART II.

Widening North Quay, Royal Albert Dock

In order to deepen the Royal Albert Dock to 34-ft. without undermining the foundations of the quay-wall, the construction of a false quay was necessary, which, owing to the comparatively narrow width of the dock, would encroach on the water area the minimum amount possible. The new quay is 19-tt. wide, and consists of a reinforced concrete deck for the crane and rail tracks carried on a deep cope-beam, bearing on cylinders spaced at 24-ft. centres, and tied into the existing quay by transverse beams at 8-ft. centres (Fig. 4).

Work started at both ends simultaneously in April, 1935, the procedure being as follows:—

FIG: 5.



PLAN OF CONNAUGHT ROAD PASSAGE.

After grabbing the dock-bottom to remove obstructions, steel guide frames were lowered on to the dock-bottom and secured in the cylinder positions by a whole-timber horizontal frame at water level. Pre-cast cylinders, each 8-ft. long, were then lowered through the guides and sunk into the foundation strata by grabbing. Two 14-in. square piles, 50-ft. long, were then driven within each cylinder, after which the cylinders were hearted to water level with 1-to-4 ballast concrete, deposited continuously by boxes with top and bottom folding doors lowered through the water. At the west end a layer of septaria was encountered, and had to be broken up by chisel-pointed steel joists used as rock-breakers. Towards the east end the cylinders had to be sunk through a hard layer of sand by divers undercutting with compressed-air spades.

Owing to the low headroom between the water level and the quay-surface, the erection and striking of shuttering for the decking presented unusual difficulties, which were overcome by the adoption of the following method:—

Near the top of each cylinder the contractor built in a length of heavy section rail with a short projection on each side parallel to the cope; on these rails special steelwork brackets were hooked to form bearings for deep steel girders placed outside the cope-line, from which hinged shuttering was suspended and held in position by long links secured by cotter pins above bearings on the existing wall.

A set of seven brackets, six girders and 120-ft. run of hinged shuttering was used at each end of the work.

As the existing coping was only 3-ft. 3-in. above impounded water-level, the new cope-level was fixed at 3-ft. 6-in. above this level, and the new decking graded inwards to a continuous drain formed along the old coping. The electric cranes, when transferred to the new crane track, were re-adjusted to suit the inward grade. Owing to the very flinty nature of the concrete of the old wall, the cutting away to form the continuous bearing for the deck and the dovetailed pockets for the anchor-beams proved a difficult operation. The broken concrete and pile-heads were deposited to weight the slope in front of the old quay. No displacers were permitted in the cylinder hearting.

The contractors, Messrs. Sir Robert McAlpine & Sons, by working continuously in two shifts, using rapid-hardening cement, and striking soffit shuttering in 72 hours, succeeded in completing the overall length of 5,450-ft. in 39 weeks, an average of 70-ft. per week at each end.

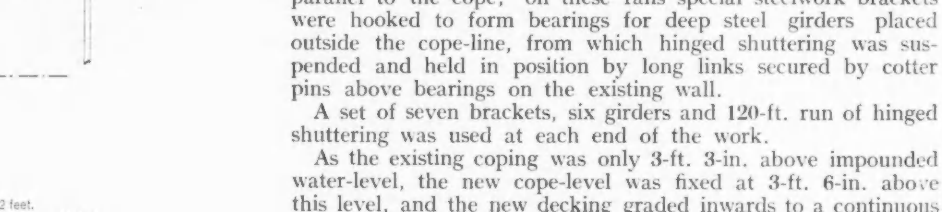
On the completion of each section the deepening of the berth was carried out by the Port of London Authority's dredgers.

The total cost of the work was £127,000, of which £42,000 was for dredging.

Works at Connaught Road Passage

Introduction.—Since the increase in the depth from 25-ft. 6-in. to 28-ft. by impounding, this passage had been the main

FIG: 6.



SECTION THROUGH TUNNELS AND SUBWAY.

* "Cold Storage at the London and India Docks." Minutes of Proceedings, Inst. C.E., vol. cxxix (1896-97), Part III, p. 1.

Improvements at the Royal Docks, Port of London Authority—continued

Placing of pre-cast Concrete Beams

General View showing process of construction at the South Quay, Royal Victoria Dock

Improvements at the Royal Docks, Port of London Authority—continued

entrance to the Victoria Dock for all shipping, and in **1930** the gates at the western entrance, which had become very troublesome to maintain, were reduced in depth and new sills formed **20**-ft. **6**-in. below Trinity High Water for the convenience of barge traffic.

The Connaught Road passage is intersected by twin railway tunnels carrying the Fenchurch Street and North Woolwich branch line of the London & North Eastern Railway at a depth which provided a cover of only **4**-ft. **6**-in. thickness of brickwork over each tunnel. The reduction of this cover to **1**-ft. **6**-in. in order to deepen the passage to give a depth of **31**-ft. required extreme caution. The twin tunnels are **120** yds. in length between the ventilating shafts north and south of the passage. The total length of the tunnel section of this line is **600** yds., and the seepage and drainage from this and the open approaches, amounting to about **400** gallons per minute, is pumped by the Port Authority at the north side of the passage. The London & North Eastern Railway have the right, in an emergency, to pass their traffic over the Port Authority's high-level railway which crosses the passage by a swing bridge.

Early in **1935**, the Railway Company approved a scheme to lower the railway lines and to strengthen the tunnels with cast-steel linings prior to the removal of **3**-ft. of brickwork cover.

A contract (Figs. **5** and **6**), let to Messrs. Chas Brand & Sons, Ltd., in August, **1935**, comprised the following:—

- (i) The strengthening by cast-steel lining, for a length of approximately **160**-ft., of each of the twin tunnels.
- (ii) The construction eastward of the tunnels of a cast-iron subway under the passage with two cast-iron shafts for the diversion of mains.
- (iii) The deepening of the passage by removal of brickwork, etc., over the twin tunnels, existing culverts, and pipe-trenches.

Tunnel Strengthening.—Before commencing work on the " down " tunnel, the Railway Company altered the approach lines and signalling for single-line working on the " up " line, the high-level lines were re-conditioned to take passenger traffic, and the Port Authority had arranged with the shipping companies for suspension of shipping traffic through the passage during the morning and evening in order that the swing bridge should be available for passenger traffic.

On making inquiries concerning tunnel-linings, it was found that in Great Britain there was no previous experience available with regard to the use of cast-steel segments for this purpose. It was considered that the ideal method would be to have each ring assembled complete before the machining of the circumferential joints, but the prices quoted and time required to deliver were prohibitive. An offer was eventually obtained and accepted in March, **1935**, for the supply of **600** tons of cast-steel segments (Fig. **7**) separately machined to a tolerance of **1/64**-in., with delivery in six months. The difficulties encountered in the manufacture of the segments, such as warping and honeycombing, and in machining, were successfully overcome, but the tolerance was not always obtainable, chiefly due to varying hardness of the metal.

The cast steel was in accordance with B.S.S. No. **30** "Castings for Marine Purposes " of quality **26** to **35** tons per sq. in. tensile strength. The thickness was **1⅛**-in. in the skin and **1¼**-in. in the flanges. All joints were machined to the full depth of the flanges. The bolt-holes, $\frac{3}{16}$-in. larger than the bolts and slightly countersunk, were drilled after machining. The segments were all **24**-in. wide, and the heaviest weighed about **9** cwt.

The south ventilating shaft was used as the sole access to the tunnels, and the contractor erected his plant and shops in its vicinity. The permanent way and ballast having been removed and the drain diverted, the brick benchings were cut away, each side wall cut back an average depth of **7**-ins. to the new profile, and the invert and soffit of the segmental arches dressed over to leave a clean surface and a **1**-in. space for grouting. The brickwork of the **4**-ft. thick division wall was cut through to form two refuges, measuring **4**-ft. by **8**-ft. The overall dimensions of the rings were **17**-ft. **1**-in. on the vertical axis and **15**-ft. **8**-in. on the horizontal axis. The flanges were **6**-in. wide.

Frequently, before erection, the segments for two adjacent rings were assembled in complete rings and bolted up to check the accuracy of the work and the efficacy of the fastenings. As a result, the bolts were increased to **5**-ins. long, and several were specially drilled and tapped to enable the jointing to be tested under hydraulic pressure. These tests showed that a water-tight arrangement was obtained by using a single strand of red-leaded hemp between the washer and the lead grummet (Fig. **8**).

The erection of the segments commenced at the centre on the **7**th October, and proceeded in both directions; usually, three rings at a time were grouted with neat cement, and finally all joints were electrically seam-welded by a specialist firm. Following this welding, the test bolts referred to above were inserted in flanges which were not a close fit, principally in the upper half of the lining, and a special portable hand-pump was used to force a liquid red lead at a pressure of **90** lb. per sq. in. in the wide joint against the back of the welding. It is satisfactory to record that only in very few instances was it possible to discern the red lead on the surface of the weld.

After an interval for the completion of the permanent way, alteration to temporary works and complete delivery of the segments required, traffic was changed over to the " down " tunnel, and work commenced in the " up " tunnel on the **12**th January. Erection commenced at the specified ring opposite the north refuge and, proceeding on the same lines as for the " down " tunnel, was completed on the **28**th March, **1936**.

In each case the inside of the tunnel-lining was coated with tar in accordance with the following specification: to **1** gallon of heated coal tar, **3** ounces each of Russian tallow and unslaked lime were added; the mixture was then well stirred and applied hot.

This section of the work cast **£27,200**, or **£85** per foot run of steel lining. The high and low-level track-work cost **£13,000** in addition.

Pipe-Subway under Passage.—The new subway (Figs. **5** and **6**) was constructed to accommodate the public and dock mains carried across the passage in three brick culverts which were affected by the deepening of the passage. The centre line was fixed at **55**-ft. east of the tunnel centre, and the south shaft at **50**-ft. normal to the quay-wall to allow of possible widening of the passage. Borings taken on the shaft-sites indicated a suitable stratum of blue clay with shells at **9**-ft. below the level for the deepening of the passage.

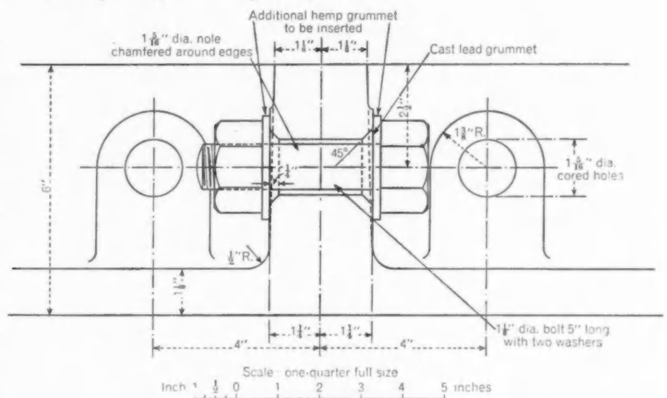


Fig. 8. Detail of Circumferential Joint for Cast-Steel Segments

Each shaft is **15**-ft. in external diameter, and consists of **35** rings, each **20**-in. deep, from impounded level to the bottom of the seal at **−44.82** N.D. The cast-iron segments are **1**-in. thick with flanges **6**-in. deep and **1¼**-in. thick after machining. The rings were held together by fifty-five **⅞**-in. diameter bolts, **5**-in. long, fixed through **1¼**-in. cored holes. Red-leaded hemp grummets were used under the mild-steel washers, and **15** per cent. of the bolts were **6½**-in. long to take hangers. The caulking groove, **1¼**-in. deep by **¼**-in. wide, was caulked with round lead.

The south shaft was sunk first. Under a timbered trench **17**-ft. deep three rings, Nos. **9**, **10** and **11** from the top, were built and concreted in; over these the steel-framed air-deck was formed and suitably weighted for the full upward air pressure, and the **9**-ft. air shaft erected with a **6**-ft. **3**-in. air-lock a few inches above surface level. Rings Nos. **12** to **35** were then excavated, built in and grouted under air pressure reaching **20** lb. per sq. in. in the south and **17** lb. per sq. in. in the north shaft. Each seal consisted of **7**-ft. of **1:2:4** concrete placed in two layers, the lower being **15**-in. thick from **4**-in. below the bottom flange, and when set this was covered with three layers of asphalt tucked under the upper flange of the bottom ring. No trouble was experienced in sinking the shaft on the north side, but in the south shaft a disused brick sewer and a timbered trench were encountered; also, air escaped and was found blowing as far afield as the approach to the tunnel, about **500** yds. north of the shaft, and it was not until two **15**-in. drain pipes found under ring No. **32** had been plugged and sealed that sinking proceeded normally. These two drains lay across the shaft parallel to the passage, and were evidently relics of the tunnel construction in **1879**.

The subway is **8**-ft. **1½**-in. in external diameter, and consists of ninety-three rings, each **21**-in. long, between the shafts, the centres of which are **174**-ft. apart. The horizontal axis is **47**-ft. **6**-in. below impounded water level. The cast-iron segments are **⅞**-in. thick with **4½**-in. flanges, **1¼**-in. thick after machining, and they were bolted together by **¾**-in. bolts **4½**-in. long, **25** per cent. of these circumferential bolts being **6**-in. long to take hangers. The caulking grooves were **⅝**-in. deep and **¼**-in. wide, and were filled with round lead.

Improvements at the Royal Docks, Port of London Authority—continued

Driving started at the south end in air at a pressure of 20 lb. per sq. in., and by working three shifts per day continuously, reached the north shaft in 22 days. A layer of septaria on the axis of the subway between the blue clay and the green sand somewhat delayed progress; these limestone boulders were very hard, and some of them, projecting more than half-way across the face, had to be cut through and broken up for removal.

At each end a collar of fine concrete was packed round the subway iron prior to lead caulking the space, averaging 2-in. wide, round the circular flange of the "picture frame" or shaft lining. Nearly 100 tons of cement was used for grouting the shafts and subway.

When the mains were removed from the existing culverts a 14-in. brick stunt-head was built across each, under the face line of the quay-wall, and the shaft end was sealed up with 8:1 concrete to 1-ft. above the crown of the culvert; the shafts above this level were then filled in.

This section of the work cost £9,600, or £35 per foot run of centre-line of subway and shafts, exclusive of £1,700 for mains.

Deepening of Passage.—The passage (Figs. 5 and 6) is about 340-ft. long by 80-ft. wide, and the undertaking was, on the completion of the tunnel-lining and diversion of mains to the new subway, to remove 3-ft. of the brick and concrete work over the 100-ft. length of the tunnel and culverts, and to dredge the remainder of the passage, all without delaying the swinging of the bridge for vessels.

The stages of the work carried out were as follows:—

(1) 28th November, 1935, to 27th February, 1936 (13 weeks). Divers cutting trench in front of footings and dressing off "toe" of quay-walls clear of tunnel area.

(2) 27th February to 20th June (17 weeks). Six divers cutting separate chases in the brickwork over the tunnels with compressed-air tools. The output averaged 1 cu. yd. per diver per week, but the brickwork and mortar were very hard, and the loss of time due to craft and shipping amounted to 33 per cent. Drilling 5-in. holes 12-in. apart, ahead of the divers, from a pontoon moored over the site of the chases, did not improve the rate of progress, as one diver was required to attend on the drill. The total cost of 134 holes, 30-in. deep, was £455. A hydraulic cartridge was tried in similar holes in a large concrete base, but the results were considered too indefinite for its use near the tunnel.

(3) 20th June to 12th July (three weeks). A floating rock-breaker with a 10-ton ram, 18-in. diameter with a shell-pointed end, was employed to crush the concrete over the culverts on each side of the tunnel. In the first cut, holes 3-ft. apart each way were penetrated to a depth of 4-ft. When the debris had been cleared away by grab-hopper, the areas were pounded a second time with holes at the same spacing but intermediate to the former. Owing to the length of the pontoon of the rock-breaker, a strip from 8 to 10-ft. wide at the quay-walls was inaccessible. Measurements showed that 330 cu. yds. had been broken up to an average depth of 3-ft. in 12 days of work carried on continuously except for traffic delays. In addition, a concrete pipe-chase, 12-ft. wide and 4-ft. thick, was broken up for a length of 62-ft. (equal to 80 cu. yds. net) during a week-end when the swing-bridge was closed to road traffic. The cost of this crushing, exclusive of removal, was about £2 per cu. yd.

The demolition of this brickwork required far more violent treatment than was anticipated, and instead of the culverts collapsing when heavily pounded by the rock-breaker, the ram punctured on one occasion the outer culvert on the east side and stuck fast for hours, delay to shipping being obviated by removing it with a 150-ton floating crane.

It should be mentioned that while this work was in progress the site was "swept" clear to the former depth by a "drag" towed by a small tug belonging to the Port Authority before the passage of each laden vessel.

(4) 2nd July, 1936, to 30th January, 1937 (30 weeks). During this period the thickness over the tunnels was reduced to about 18-ins. by miners working in a diving bell, the compressed air for both tools and bell being supplied by a 3-in. main laid from the dry docks.

In the first instance, a small cast-iron bell belonging to the Clyde Trust was used; this weighed about 10 tons, and was slung over the end of the Authority's 30-ton floating crane moored alongside the north wall and connected to the air-main with two 50-ft. lengths of 3-in. flexible hose. The cuts were about 12-in. deep and were taken out in strips, 5-ft. wide, by the crane heaving along the wall as required and slewing out for each new strip. On completion of the second 12-in. cut over the north half, the crane was transferred to alongside the south wall and worked over the south side as above. The third and final 12-ins. were taken out by a rough cut of 9-in. two strips in advance of a final cut of 3-ins.; the depth for the final cut was measured from a straight-edge suspended in the bell at a fixed distance from impounded-water level, any variation in which was communicated to the miners by telephone.

The work was carried out continuously in three 8-hour shifts, from 10.30 p.m. on Sundays to 2.30 p.m. on Saturdays; that is, seventeen shifts per week. The small bell was 6-ft. 5-in. long by 6-ft. wide internally, and was manned by two miners per shift, who took turns in drilling and collecting the broken material. They were paid 21s. per shift, plus a bonus of 1d. per bucket for the first thirty buckets per shift, and 3d. per bucket thereafter, and it was agreed that ninety-eight buckets had to fill a box measuring 44 cu. ft. 1 cu. ft. of this material weighed 73½ lb., whereas it weighed 125 lb. when solid. The output from this bell averaged 15½ cu. yds. per week over the 14 weeks it was in use.

With a view to doubling the output, a steel bell was constructed, 10-ft. 5-in. long by 6-ft. 6-in. wide, to accommodate four miners, and was equipped with a 2-in. air-pipe and valves for three air-tools, and also four longitudinal seats to slide into position as shelves to receive the broken material. This bell was used by the three shifts for nine weeks, and averaged just under 21½ cu. yds. per week, all from the third cut. It was also used on single shifts for seven weeks, skimming over and removing "pimples" from the whole area.

The rectangular pontoon of the floating crane with a beam of 41-ft. sheltered the bell and enabled the miners to work in safety, whilst leaving ample room for tugs and craft to pass in single file, thereby eliminating, when working clear of the radius of the swing-bridge, 19½ of the 33 per cent. delays previously referred to. The weight of the steel bell was 15 tons, but when loaded the weight on the hook of the crane, inclusive of sling chains, was 20 tons. A diver and linesman were in charge of the diving bell day and night, and the telephone proved reliable and useful, but signals from the miners to the crane were made much quicker by push bell. With the aid of two electric lights fixed in the bell every joint in the brickwork could be seen, and when accustomed to the difference in pressure the working conditions inside the bell were ideal for the job. By this means 440 cu. yds. solid were cut and removed, at a cost of £17 per cu. yd, inclusive of the working costs, but not of the hire of the floating crane and compressors.

(5) 30th January to 9th April, 1937 (10 weeks). During this period, two divers were employed dressing off the brickwork at the junction with the quay-wall for a length of 100-ft. on each side of the passage. A steel template, bent to a radius of 6-ft. and suspended from the coping to the required depth, was used for this purpose.

In the period covered by the deepening it was necessary to close the swing-bridge to rail and road traffic for ten week-ends during which provision had to be made for pedestrians and perambulators to cross the passage by pontoon and gangways, which had to be removed for, and replaced after, each vessel.

The total cost of this deepening, including dredging and grabbing the full length of the passage, amounted to £17,500, which, added to the cost of the two other sections, made the total £70,000.

(To be continued).

Use of Thames Steamers for War-time Hospital Service

The following announcement in connection with A.R.P. measures at the Port of London has been issued to the press.

Arrangements are being completed by the Port of London Authority in conjunction with steamship and motor-boat owners for a river-rescue service, to be used in times of emergency.

Part of the service will be a river ambulance section, for which 14 pleasure steamers are being equipped as hospital ships. Each of these ships will be capable of accommodating 120 casualties, and will be fully staffed by doctors, nurses and volunteers who are now being recruited for the work.

It is understood that the service will work from Teddington Lock to the Estuary. Between these points the river will be divided into 14 sections, each with a shore post linked up by telephone. Working between the steamers and the docks and wharves in each section will be a small fleet of motor-boats, which will pick up casualties and transfer them to the steamers for medical treatment.

The principal object of the scheme is to relieve congested streets in Central London. Casualties will be taken from first-aid posts to the riverside and transferred by hospital ships to less crowded areas. One important advantage of the steamers will be their capacity to carry 120 persons, compared with two in an ordinary ambulance. Also, if ever the necessity arises, hospitals near the river can be evacuated by the steamers.

It is understood that the vessels to be used for this service have already been ear-marked, and that steamers and motor-boats used in normal times for pleasure purposes will be taken over immediately a state of emergency is declared.

Correspondence

From Commander P. Froud, R.N.R.

To the Editor of "The Dock and Harbour Authority"

Sir,

Graving Dock Fires

With reference to your Editorial comments on Graving Dock Fire Risks in your February issue, there appears to be a simple explanation of the cause of fires in vessels immediately after refit which I have not yet seen mentioned.

During refit a vessel's dynamo is not in use, and temporary lighting is supplied from the shore, but usually only for those compartments undergoing repair. Most vessels are equipped with wandering leads or portable electric hand lamps in store rooms and linen lockers.

While a vessel is refitting a person may, for instance, visit a linen locker, switch on the wandering lead and, of course, obtain no light as the ship's dynamo is not working. He may or may not hang the wandering lead up again. Usually, he throws it down on a pile of linen, where it becomes buried under other linen. As soon as the vessel is ready for sea the dynamo is started and the wandering lead, which has been left switched on, catches fire to the linen.

It is not generally known that an electric light bulb if completely covered by cloth will gradually heat and set fire to its surroundings. I have seen a fire started in this manner and, but for the fact that it was detected in time, would have had serious consequences.

I am, Sir,
Your obedient servant,
G. FROUD,
Harbour Master.

Harbour Master's Office,
King's Quay Street, Harwich.

February 7th, 1939.

From Professor Jorge Lira.

To the Editor of "The Dock and Harbour Authority"

Dear Sir:

Wave Pressures

In an article published in the November last issue, headed "The Construction of Breakwaters," signed by the Engineer, Mr. Stanley C. Bailey, dealing on the subject of wave pressure against upright breakwaters, he refers to an article published by me in the "Le Génie Civil," on February 5th, 1927, and says I have estimated that the wave pressures in reference can reach from 4 to 4.82 tons per square foot.

Undoubtedly, in these ciphers there is either an error in printing or a lack of explanation, because I have never considered possible pressures of such magnitude.

In the article to which Mr. Bailey refers, I have not quoted any cipher in a general sense, but I state an example based on comparison, that allows you to form an idea of the pressures obtained, or rather the pressures that the breakwater is considered to resist.

Those pressures taken at their highest point are 6.08 and 9.26 tons per square metre, which is equivalent to 0.56 and 0.86 tons per square foot, which are smaller ciphers to those which Mr. Bailey refers to in his article.

In the reports I delivered to the "International Congress of Navigation" in 1926 and 1935, mainly in the latter, I had the opportunity of quoting many ciphers either the results of calculations made or mensurations, and those ciphers always indicate maximum super pressures, which could be compared with those which would result considering waves of 2h in height.

I would be very much obliged to you for the publication of these lines, and I have the honour of presenting to you my most respectful compliments.

Yours sincerely,
JORGE LIRA,
Head of the Department of Maritime Works,
Ministry of National Defence, and
Professor of the Catholic University of Chile.

Santiago, Chile.

January 3rd, 1939.

The foregoing letter has been submitted to Mr. Bailey, who replies as follows:—With reference to the letter of Prof. Jorge Lira dated the 3rd January, 1939, the paragraph in my article on "The Construction of Breakwaters" referred to an estimate in an article by him on the effects of a wave 6 metres high, and 90 metres long on two breakwaters in which he mentioned pressures of 4.44 and 5.28 kilogrammes per sq. centimetre, which are equivalent to 4 and 4.82 tons per sq. ft. respectively.

These figures apparently only apply to the estimated stresses produced by heavy waves on the breakwaters, and not to the actual wave pressures, the error, I regret, being due to a mistranslation.

To the Editor of "The Dock and Harbour Authority"

Dear Sir:

Harbour Hydrography

I have just read the article "Echo Sounding in Harbour Hydrography" by Lieutenant Commander D. H. MacMillan, R.N.R., in the August, 1938, issue of The Dock and Harbour Authority. This instructive article indicates a complete understanding of the problems confronting the hydrographic surveyor in his efforts to attain accuracy in his work.

Of particular interest to me is the reference, on page 300, to the "working sheets" upon which arcs are so plotted that they can be used as co-ordinates for position finding. Similar sheets, called "sextant charts," have been used in surveys of the Delaware River by the Philadelphia District of the U.S. Army Engineers for the past twenty years, and have proved very convenient and accurate.

About one year ago this office prepared a paper on the theory, construction and use of sextant charts. In addition to an explanation of the basic principle involved, there is given in the paper a concrete example of sextant chart construction, including the necessary computations and drafting technique.

A copy of this paper* is enclosed, as I believe it will be of value to anyone interested in hydrographic surveying who is not familiar with the quick and accurate method of position finding mentioned by Lieutenant Commander MacMillan.

I wish you continued success with your excellent publication.

Very truly yours,
L. D. SHUMAN,
Principal Engineer.

War Department,
United States Engineer Office,
Philadelphia, Pa.

January 10th, 1939.

National Harbour of Refuge for St. Ives

Appeal by the Mayor

The following statement has been sent for publication:

Time and time again the Town Council of St. Ives have urged upon the Government departments the absolute necessity for the provision of an adequate breakwater in St. Ives Bay. During the Great War there were sheltering in the Bay over 50 vessels in one week. Had the wind veered to the North-West, as it very often does, more than half of these would have dragged their anchor and been wrecked with great loss of life. This had, indeed, actually occurred. On one occasion three M.L. Torpedo Boats anchored in the Bay were forced, by gale, to put to sea in an effort to get around Land's End; one caught fire and was lost, another was driven ashore near Clodgy, St. Ives, and was lost with all hands; one only escaped.

Both the Admiralty and Ministry of Agriculture and Fisheries have turned a deaf ear to the Council's appeals, and the only help they have offered is a comparatively small contribution to a scheme, the cost of which St. Ives alone could not possibly meet.

Tragedies such as that of last week-end must inevitably recur while nothing is done to provide shelter on the North Cornish coast for vessels in difficulty. Not only is it of local value, but essentially of great national importance, in view of the submarine menace which, as everyone knows, took a heavy toll of merchant shipping within sight of St. Ives Head, but with no shelter to make for and no breakwater behind which fighting vessels could shelter, merchant vessels and, indeed, vital food supplies of the country were entirely at their mercy.

To confirm the opinion that St. Ives warrants a National Breakwater:

The members of the Royal Commission reporting on National Harbours of Refuge, were of the opinion that the claims of St. Ives were paramount to all others, as embracing a wider scope of usefulness, available for the general navigation of the country and of the world.

One Royal Commission has recommended a National expenditure of £400,000 for a 4,000-ft. breakwater.

Sir William Matthews, in 1906, in an official report by him, said that he considered St. Ives to be the most suitable site for a National Harbour of Refuge. Since that time the necessity for a harbour of this kind has greatly increased by reason of the enormous development of the Bristol Channel ports, and the fact that these ports will be used to capacity in connection with armament manufacture in South Wales; they will also receive the greater bulk of the nation's food supplies in time of war. In fact, the case for a National Breakwater in St. Ives is overwhelming.

There is a deep feeling of regret throughout the whole town of St. Ives that the past efforts of the Council have failed to rouse successive Governments to a sense of their obvious responsibility in a matter of such grave national concern.

(Signed) CHARLES W. CURNOW,
Mayor.

January, 1939.

---

* To be published in a succeeding issue.

Transporting the Grain Harvests of the World

By CECIL BENTHAM, M.Inst.C.E., M.I.Mech.E., M.InstT.*

(Continued from page 116)

SECTION IV

Grain Transport and Storage Conditions in other Countries.

Australia

About twenty years ago New South Wales introduced a bulk handling scheme. A large terminal shipping silo was built at Sydney, and a number of country silos were built in various districts to make it possible to use bulk transportation on the railways. The country silos have been further developed until New South Wales is now fairly well equipped. In spite of the existence of these silos, a large proportion of the grain is still transported in sacks, and this may be influenced to some extent by the objection of shippers to transporting across the ocean in bulk.

Other States in Australia are at the present time building silos, and bulk handling is spreading fairly rapidly; but handling and storing in sacks still prevails on a very large scale.

By courtesy of] Shipping Elevator. Buenos Aires Great Southern Railway, Argentine [Henry Simon, Ltd.

South Africa

This country now produces approximately sufficient wheat for its own requirements, and importation from Australia has declined almost to vanishing point.

A complete system of silos for handling maize in bulk was introduced in 1924. This system consisted of a number of country silos and terminal shipping silos at Durban and Capetown. Exports of maize from South Africa amount to 400,000 tons annually.

This system in South Africa is the only example of a complete system throughout a country which has been introduced by one transport authority—the Railway and Harbour Authority of the Union of South Africa—for handling the whole of the particular crop.

Russia

Prior to 1914, Russia exported large volumes of grain, and in recent years has again exported on a fairly large scale, but the effect on world exports is not so pronounced as formerly. Nevertheless, Russia, taking both European and Asiatic Russia as one, is, on the most reliable authority available, the largest producing country in the world of wheat, oats and rye, and also has a very large production of maize and barley.

Circumstances do not permit of information being presented on transport conditions in Russia, but it is evident that production is increasing and that the country is well provided with waterways suitable for transporting grain in the most economical manner. A number of new grain silos have been built and modern grain-handling appliances installed. The potential effect of Russian exports of grain on world supplies in the near future is very pronounced.

China and India

China and India, two very large producers of grain, have no special equipment for storing and transporting grain by modern methods. Hand labour in these countries is still very cheap, and it has been difficult to justify the installation of storage silos and equipment with mechanical handling methods because the cost of moving grain in sacks by manual labour is so small. A further reason for not installing large grain stores is that the grain is consumed mainly within the country and the movements do not tend to concentrate on certain points to such an extent as in other countries where a large proportion is exported or where the industrial population is a long way from the grain fields. In these circumstances the cost of silo buildings and mechanical appliances cannot reasonably be justified as compared with simple sheds or storage in the open. In these countries also where weather conditions are more definitely periodic than in Britain, grain in sacks can be stored in the open with very little risk of damage during a large part of the year. Nevertheless, there is a very considerable loss owing to the primitive method of storing, which would be avoided by a better system.

In India it has been stated that the loss may be anything from 5 per cent. to 10 per cent., which over a crop of ten million tons becomes a very large total amount.

The first silo in China was recently constructed near Shanghai, and it was hoped that other silos might shortly follow, but this hope has now been deferred owing to the disturbed conditions in that country.

SECTION V

Reception, Storage and Transport of Grain in Europe

As already mentioned, Continental Europe has been equipped with a number of grain storage plants, starting originally from small beginnings. These have gradually been built up to plants suitable for proved requirements in the parts of Europe which produce sufficient grain for their own needs. The store is usually connected with the mill, and transit storage is not such a complicated problem as in exporting countries.

The practice on the Continent is in many respects similar to that obtaining in the British Isles with the exception that the British Isles have developed to a much greater extent the equipment for handling imported grain. The ports in this country are the focus to which grain comes from different parts of the world, and the points from which transport radiates to the consumers.

The grain stores in the British Isles can be broadly divided into two classes: (a) public silos, (b) flour mill silos.

Most grain ports have provision for discharging ships and storing grain, owned and controlled so as to be available to any user. London has several grain stores owned by the Port of London Authority. Liverpool, one of the first ports in the world to store grain in bulk and to use bulk conveyors for distributing grain in the stores, has grain warehouses owned by the Mersey Dock Board, but the more recent grain stores built in Liverpool are owned and controlled by a grain storage company. These silos are in the nature of public granaries open to all owners of grain. One outstanding recent example of a modern silo for general use is the one built for the Liverpool Grain Storage Company having a capacity of 60,000 tons.

Bristol, Leith and Glasgow have public stores owned by the port authorities. Hull has a large public grain store owned by the railway company, who also own and operate the docks. Manchester has large grain stores owned by a subsidiary com-

* Abridgment of Lecture delivered to the Institute of Transport in London on October 18th, 1938. Reproduced from the Journal of the Institute by kind permission of the Council.

Transporting the Grain Harvests of the World—continued

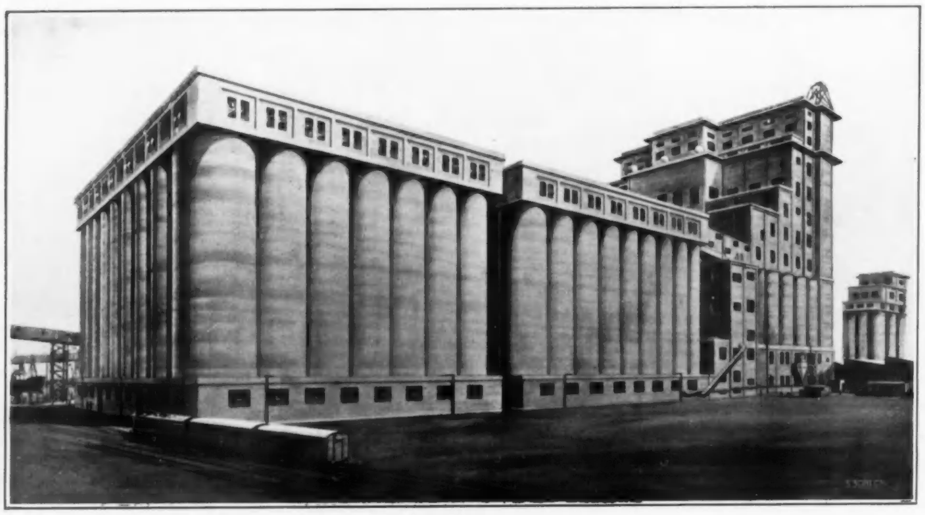
pany of the Ship Canal Company which, in this case, is also the port authority.

In recent years the outstanding tendency has been to build new flour mills adjoining deep-water berths, so that a grain silo can also be built adjacent to the mill. As a result, grain can be taken from ocean-going ships directly into silos and from there by conveyor to mill, thereby reducing drastically the transport charges within this country.

When it is realised that these mills can also be conveniently situated for distribution of flour to large centres of population the economic advantages of this development are obvious.

This country has a number of ports with large industrial populations within easy reach, and it is due to this fact that the population is able to live under such favourable conditions. Grain can be drawn from all parts of the world and distributed for consumption both to human beings and animals at a very low cost.

During the last ten years cases of combined development of flour mills and grain stores at deep-water berths have occurred at the following places:—London, Cardiff, Avonmouth (three mills), Newcastle, Belfast, Limerick, Cork, Liverpool, Southampton.



[By courtesy of Henry Simon, Ltd.]

Grain Elevator. Ingeniero White, Bahia Blanca, Argentine. Capacity 140,000 tons

Methods of discharging ships are very similar in all cases. Grain is taken from the discharging plant to the silos by conveyors, these conveyors being housed either in gantries or underground passages. In some cases the grain is transported on belt conveyors a distance of as much as half a mile from the point of discharge to the silo, but usually the silo is kept as near to the quay as the site allows. There is no reasonable objection to building a silo some distance away from the quay, since the method of conveying on belts is extremely simple and very cheap.

In all cases provision must be made for weighing grain as it comes from the ships, and in public silos it must be possible to retain the grain in separate parcels. Usually, some provision is also made for cleaning and drying.

For the purpose of checking the conditions of grain whilst it is stored, it is now usual to provide temperature indicators in the bins, which readily show any tendency to heating of the grain. If heating does occur the grain is aerated by running it out of the bins over mechanical appliances and feeding it back into another bin, a process known as " turning over."

Modern silo buildings are usually impressive structures. At one time anything on a dock was made extremely plain and possibly ugly. Attention is now being paid to appearance, and the recent installations, specially those combined with flour mills, have a good appearance as well as being constructed to serve their purpose efficiently.

One point of importance in connection with these buildings is that a special method of construction has been developed, known as the sliding form construction. Originally, this method was used solely for grain silo bins where plain walls were required for a considerable height, but as the result of experience gained on grain silos, the method has now been adopted in connection with other types of buildings. The timber or steel form used during construction is prepared near the ground level to the shape of the walls required. This form covers the whole of the area to be built at one time. Provision is made for lifting the forms over the whole area simultaneously by a large number of jacks. When everything is ready the form is slowly raised, whilst reinforcing steel is placed in position and concrete is poured into the space left for the wall; this is done continuously night and day until the walls are as high as it has been decided to go. It is not unusual for the walls to grow by this method of construction at the rate of 6-ft. or 8-ft. per day, so that in one or two weeks a building may have grown from ground level to a height of 90 or 100-ft.

Grain Cleaning and Drying

When grain is delivered direct from the producer to the consumer personal bargaining regarding prices and personal judgment regarding quality are the only necessary factors.

As the grain is distributed more widely, it passes through a number of hands on its journey between producer and consumer; consequently, methods of fixing some standards of quality become more necessary. The most scientific methods are in use in U.S.A. and Canada for grading grain in such a manner that all the world knows its particular characteristics. Other countries which have not adopted grading systems must still sell their grain by a general description, such as " fair average quality " or " No. 1 grain," or by samples, specified bushel weights, etc. Most of these methods allow for a more or less recognised amount of material foreign to the grain.

Grain when harvested contains certain impurities, much of which is earthy dust. The cost of transporting this dust is clearly a complete waste; in organised schemes the dust should be eliminated at as early a stage as possible. Not only is the cost of transport lost but handling the dusty grain produces very unpleasant conditions for the men engaged. It also creates unsightly, and in some circumstances, dangerous conditions.

In some countries wheat has over 5 per cent., and barley up to 20 per cent. of impurities, which are capable of being easily removed before transportation. In a country producing a million tons and taking the lower figure 50,000 tons of useless material is transported.

It will readily be realised that where effective checks cannot be applied there is a great financial temptation to sell grain with as much dirt or other foreign matter in it as possible, and cases are on record where dirt has actually been added for the purpose of increasing the weight of the grain. Such cases today can be regarded as exceptional, but it is evident that it would be sound economy not only to prevent such additions but also to take out natural foreign matter at an early stage in the transportation of the grain.

After grain is cleaned it should be under such control that it cannot afterwards be adulterated. For instance, when a Canadian grade of grain is once established it can be checked at any time and adulteration readily discovered.

Where grain is handled in bulk it is usual to equip country silos with a simple cleaning machine known as the separator. These machines take out heavy dust by means of shaking screens, and light dust by means of air currents. At the same time foreign matter, such as sticks, straws, stones, etc., are extracted. When grain reaches large silos it can be treated in a more thorough manner by more complete installations of machinery which, in addition to taking out foreign matter, can be used for separating different grains, such as oats from wheat. In parts of the Argentine as much as 30 per cent. of oats come to the terminals mixed with the wheat. The various cleaning machines prepare grain for railing or shipping to destination in the most economical condition. The saving in transport charges is great, and the market value of the grain is enhanced.

There is still much scope for fuller utilisation of cleaning machinery in many centres with or without storage silos or bulk handling, and this would be to the fundamental benefit of the consumer, dealers and producer alike.

Pneumatic plants in use in Europe for discharging grain are fitted with apparatus for returning to the grain the dust extracted in the process of discharging. This practice is not necessary where mills take in their own grain, but where shippers and grain storage companies act as carriers only, they are expected to deliver as much as they receive.

Driers are used on terminal grain stores primarily to bring grain into suitable condition for storing or transporting. When a wet harvest occurs trouble would be experienced if the moisture content is too high. Incidentally, a reduction of the moisture content reduces the weight to be transported, and hence the cost of freight. With very wet grain as much as 5 per cent. moisture may be extracted, and on a 10,000-ton cargo this would mean a saving of freight charges on 500 tons.

Transporting the Grain Harvests of the World—continued

Insect Pests

With modern means of quick transportation it is obvious that insect pests which attack grain can be distributed throughout countries where otherwise they would not be found, and the damage caused in the country of origin is therefore spread and carried throughout whole continents.

Since grain is stored for considerable periods before, during and after shipment, it is well to consider what precautions must be taken to minimise the damage and inconvenience caused by insect pests.

Many people are familiar with the immense amount of damage and trouble caused in Australia towards the end of the last war where huge stocks of grain had accumulated. These stocks were still lying there in 1918 and 1919, in spite of the fact that the majority of the wheat was purchased in 1916. Due, however, to the activity of submarines, delivery of the wheat was reduced to a minimum, and the huge stocks lying in the open in bags were very severely infested with granary weevil, rice weevil and mice. The losses actually caused and the possible future losses were gigantic, and a Royal Commission was appointed to examine the methods of checking this immense waste, and to discover means of recovering the undamaged wheat. The plague was checked, the pests were killed, £26,600,000 worth of wheat was saved, and methods were evolved for preventing such an occurrence in future years. Since that time such extensive progress has been made in storage and treatment that it is unlikely that any similar immense waste of grain will again take place.

The chief lesson learned is that access to grain provides the quickest method of pest contamination. If the grain is stored in silos further infestation from outside sources is not likely to take place so easily; in fact, it is extremely difficult to see how infestation can take place from an outside source in modern silos. If the grain is dried before storage, multiplication of insect pests is less rapid since conditions are not so favourable when the moisture content of the grain is kept below 12 per cent.

Rail wagons, barges, ships, etc., should in extreme cases be sterilized after it is known that infested stores of grain have been handled.

SECTION VI

Cost of Transport

The cost of transporting grain from all sources is not readily available, but some idea may be formed regarding the proportion which this cost bears to the value of the grain from figures compiled by the Canadian Society of Agriculturists.

The approximate average charges between the producer in Western Canada and the arrival of the vessel at British ports, per bushel of wheat, have been computed by the Board of Grain Commissioners for Canada. The average cost per ton on exports via Montreal-Sorel-Quebec for the calendar year 1934 are translated as follows:—

	Cost per ton £	s.	d.
1.—Handling at country elevator (including insurance against loss by fire and storage for 15 days); official inward inspection, weighing and registration fees; and selling to exporter on Winnipeg market ...	0	5	7½
2.—Railway freight rate from average western point shipping to Fort William-Port Arthur terminal elevators ...	1	0	3
3.—Handling at terminal elevators (including insurance against loss by fire or explosion and storage for 15 days); official outward inspection, weighing and registration fees; and loading into vessel ...	0	2	3
4.—Lake freight, Fort William-Port Arthur to Montreal-Sorel-Quebec (including costs of trimming cargo, brokerage, lake and out-run insurance, and any charges incurred for transfer of cargoes from upper lake to canal-size vessels)...	0	9	7¼
5.—Approximate average cost of freight and insurance (marine and out-run) between Montreal-Sorel-Quebec and British ports calendar year 1934, including fobbing charges at Montreal-Sorel-Quebec ...	0	9	6¼
Total approximate cost between producer and c.i.f. British ports, per ton of wheat ...	£2	7	3

Another method of stating the cost of transport is given in "Agriculture and the Trade Cycle," London, 1933, Appendix IV. This shows the cost of transporting wheat from farm to wholesale market or to the port mill in England. This information is based on figures from Canada to Liverpool in 1931.

From farm to wholesale market or to mill as grain. Canada to Liverpool, 1931. Primary distribution charges of wheat. Percentages of Liverpool price.

Country elevator charge ...	4.7
Rail from Saskatchewan point to Fort William ...	18.0
Lake shipper's charges at Fort William; loading, inspection, weighing ...	2.0
Insurance, out-run and brokerage at Lake ...	1.0
Lake freight, Fort William to Montreal, including vessel brokerage and terminal unloading ...	12.7
Handling, brokerage, wharfage, etc., at Montreal ...	.7
Loading and freight, Montreal ...	8.0
Out-run and marine insurance ...	1.3
Total ...	48.4
Growers' proportion ...	51.6
	100.0

The proportion of wholesale receipts going to distributors is rather high in this example, since the 1931 prices were very depressed. On the basis of 1929 prices the proportion of distributive cost was nearer 35 per cent., and 65 per cent. is a fair estimate of the grower's proportion.

This indicates the importance of the cost of transport as a proportion of the total value of the grain when it is landed in England.

As compared with this long-distance cost of transport, it may be noted that the freight rate from Liverpool to Leeds, a distance of 70 miles, is 13s. 4d. per ton. This one short haul is 28 per cent. of the total cost from country elevator in Canada to Liverpool, which may involve a travelling distance of 6,000 miles with loading and discharging at each end of the journey and three transhipments during the journey. The relative cost per ton for transporting grain in this country is one of the primary economic reasons underlying the present tendency for new mills to be built on deep-water berths at British ports.

Another case will be interesting. In the Government of India report on the Marketing of Wheat in India, typical price figures are given for transporting wheat between important centres where a surplus exists and the consuming market. The figures for Lyallpur via Karachi to Liverpool are as follows:—

	per cent.
Wholesale and retail margins ...	4
Distributing charges at destination ...	4
Steamer freight ...	5
Expenses at Karachi ...	3
Rail freight ...	20
Costs at source (f.o.r.) ...	4
Assembling charges ...	2
Cultivators' prices ...	58
	100

Total expenses amount to 42 per cent., as compared with 58 per cent. going to primary producers.

Conclusions

1. The world is capable of producing sufficient grain to feed all its inhabitants. The possibility of famine may be eliminated and the danger of shortage reduced by efficient transport and storage facilities.

2. The good standard of living which exists in certain countries is due very largely to cheap and efficient transport of grain. In other countries where the standard at present is low, it should be possible to raise it by better organisation of supplies and improved transport facilities.

3. Although the present wave of economic nationalism may be justifiable, it is having the effect of preventing the most efficient utilisation of the resources of the earth, particularly as regards its grain supplies.

4. The total production of grain over the whole world is fairly uniform but, as consumption increases in certain countries, other countries tend to increase their production. There is scope for increasing production by obtaining higher yields in existing grain-producing areas, and also by bringing new areas under cultivation.

5. On the main transport routes it is important that all modern facilities should be utilised for economically and expeditiously moving the grain from producer to consumer. The main sea routes are of primary importance to this country.

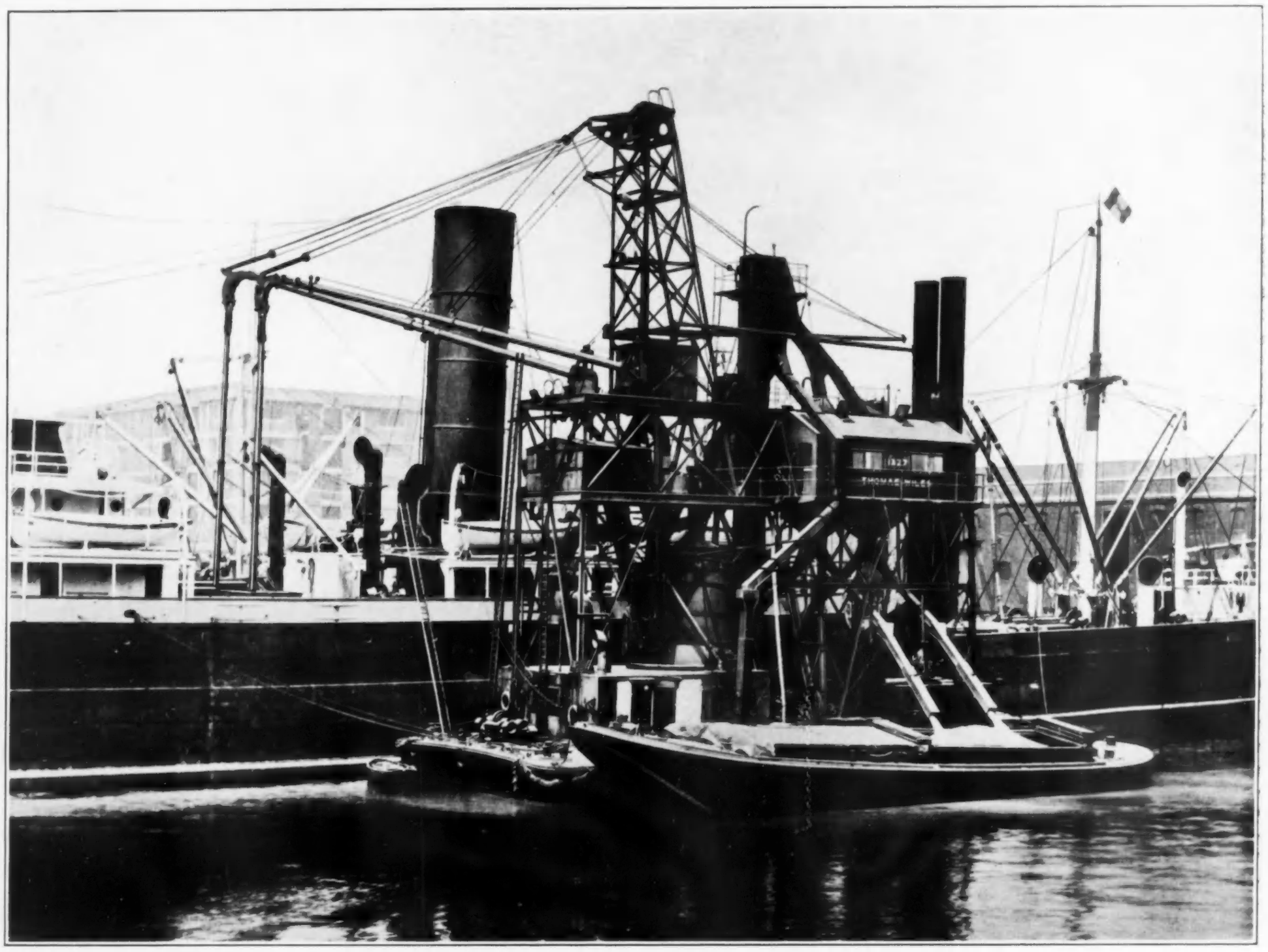
6. Transport of grain in bulk has proved to be the most economical for loading and unloading ships, and this method of transport is developing. Shipping grain in sacks is still widely practised in countries where the cost of labour is low, but this offset by enhanced cost of discharging in the countries of reception.

7. Safety of ships with bulk cargoes is ensured by accepted methods of stowage. Better understanding of ventilation is reducing the risk of grain going out of condition during long voyages through hot humid zones.

8. Storage and handling in bulk originally developed in North America, but is spreading rapidly to other parts of the world, and is likely ultimately to be the accepted method in all grain exporting countries. Importing countries are already prepared for discharging ships and storing imported grain in bulk.

9. Handling appliances suitable for loading and unloading ships have been developed to suit all circumstances, and in Europe pneumatic ship discharging plants have established themselves as the most suitable.

Transporting the Grain Harvests of the World—continued



By courtesy of] **Floating Pneumatic Plant—Port of London** [Henry Simon, Ltd.

10. Shipping and storing in bulk in exporting countries is simplifying the working of the railways, and the capital outlay on grain plants is balanced to some extent by reduction in outlay on rolling stock.

11. In developing countries there will in future be a greater necessity for the introduction of bulk handling to bring conditions up to the standard already existing in other countries.

12. In Europe, particularly in the British Isles, a fundamental economy in transport costs has been secured during the last decade by the progress made in the construction of large grain silos combined with modern flour mills.

13. Recognised grading is desirable for all exported grain, because this gives both the growers and the exporters a fair reward for their efforts and creates confidence in the consuming market. Cleaning and drying are a corollary of grading, and also effect enormous reductions in transport costs.

14. Insect pests are a source of considerable loss, and infested grain when transported tends to spread undesirable insects to different parts of the world. More treatment is necessary to check this.

15. The combination of grain traders, transport organisations, and engineers has brought the benefit of proper grain supplies within the reach of all mankind.

16. There is still considerable scope for research work in regard to the methods and cost of transporting grain from the field to the mill.

Dock and Harbour Authorities' Association

Report* of the Executive Committee for the Year ended 31st December, 1938, presented at the Annual General Meeting held on February 22nd, 1939

Executive Committee

The Committee for the ninth successive year elected Lord Ritchie of Dundee, the Chairman of the Port of London Authority, as their Chairman.

Towards the close of the year Sir David J. Owen, who has represented the London and South Coast District on the Committee since 1928, retired from his position as General Manager of the Port of London Authority, and the Committee wish to record their appreciation of his valuable services to the Association.

Sub-Committees

Cmdr. W. W. C. Frith, Harbour Master, Tyne Improvement Commission, was added during the year to the Buoyage and Lighting of Coasts Sub-Committee, and Mr. H. Le Mesurier, Solicitor to the Port of London Authority, was added for Parliamentary Matters to the Parliamentary and General Matters Sub-Committee.

* Slightly abridged.

Members

The Association this year comprised 54 Authorities, dealing with a tonnage (excluding Pilotage, Conservancy and Eire Authorities not covered by the Board of Trade Returns) representing over 75 per cent. of the total tonnage of vessels arriving and departing with cargoes at and from the ports of the United Kingdom. One Authority, the Whitehaven Harbour Commissioners, joined the Association during the year.

Bills in Parliament

The under-mentioned Bills were considered and amendments sought where necessary to protect the interests of Members.

I. Session 1937-38

(1) Bills which passed into Law

(a) Public Bills

	Royal Assent, 1937
Merchant Shipping (Superannuation Contributions)	Dec. 9th
	1938
Coal	July 29th
Essential Commodities Reserve	July 29th
Finance	July 29th
Fire Brigades	July 29th
Food and Drugs	July 29th
Holidays with Pay	July 29th
Rating and Valuation (Air Raid Works)	July 29th
Rating and Valuation (Air Raid Works) (Scotland)	July 29th
Sea Fish Industry	June 2nd
Street Playgrounds	July 13th
Young Persons (Employment)	July 29th

Dock and Harbour Authorities' Association—continued

(b) Private Bills

Lancashire County Council (Rivers Board and General Powers) ... ... July 29th

(2) Bills which did not pass into Law

Annual Holiday; Coast Protection; Docking and Nicking of Horses (Prohibition); Employers' Liability; Licensing of Advertisements (Scotland); Limitation; Prevention of Fraud (Investments).

II. Present Session 1938-39

Bills Pending.—(a) Public Bills

Census of Production; Coast Protection; Limitation; Local Authorities (Enabling); Prevention of Fraud (Investments); Workmen's Compensation.

(b) Private Bills

Dover Coal Dues (Abolition); Southern Railway.

(c) Scottish Orders

Port Glasgow Burgh and Harbour.

Fire Brigades Act, 1938

This Government measure which received the Royal Assent on the 29th July, is important for the reason that for the first time a statutory obligation is imposed upon local authorities to provide fire protection for all property in their areas, and to co-operate with each other in dealing with large fires.

The Committee took steps to obtain an amendment to Clause 1 (7), now Section 1 (8), to provide that fire alarms shall not be placed where they might obstruct or render less convenient the access to or exit from, *inter alia*, premises belonging to statutory undertakers (including dock and harbour authorities) and used for the purposes of their undertaking.

A great deal of discussion took place in connection with Clause 4 of the Bill which provided that any enactment entitling a fire authority to receive remuneration for its fire services, other than for extinguishing fires in chimneys, should cease to have effect.

The clause, now Section 5, was eventually passed in substantially the same form as in the Bill when introduced.

Essential Commodities Reserves Act, 1938

This Government Bill received the Royal Assent on 29th July.

As its title implies, it is a defence measure and enables the Board of Trade to obtain information as to commodities which would be essential in time of war, and to make provision for the maintenance of reserves of such commodities.

Essential commodities are defined in the Act as any commodity which may be declared by order of the Board of Trade to be a commodity which in the opinion of the Board of Trade may be required as food for man, forage for animals or fertiliser for land and any raw material from which any such commodity can be produced, also petroleum and any product of petroleum.

Section 2 (2) gives the Board of Trade power to acquire and store stocks of essential commodities, and for the purpose of such storage to do all such things (including the execution of works and the erection of buildings) as may appear to them necessary for the storage, preservation and transport of such stocks.

The Committee considered it desirable to ascertain whether this sub-section would give the Board of Trade power to acquire compulsorily land of dock authorities and erect warehouses thereon, which might, when the emergency had passed, come into competition with existing warehouses.

An amendment was therefore moved by Mr. Moreing, M.P., on Committee Stage of the Bill on 16th June with this object in view, and the President of the Board of Trade (Mr. Stanley), in resisting the amendment, said:

> "The Bill gives no power of compulsory acquisition, and it is not anticipated that we shall have to spend millions putting up warehouses all over the country which will be afterwards standing in competition to other warehouses."

Street Playgrounds Act, 1938

Action was taken on this Private Member's Bill to ensure that roads belonging to or repairable by dock undertakers or railways or forming a means of access to docks or railways should not be closed by an order to enable them to be used as playgrounds.

In conjunction with the Railway Companies an amendment to the above effect was set down to Clause 1 and moved by Cmdr. Marsden before Standing Committee "B" on 3rd March. The amendment was, however, withdrawn in consequence of a statement by Capt. Hudson (Parliamentary Secretary to the Ministry of Transport) to the effect that the Bill was only intended to apply to culs-de-sac and small streets of no traffic value.

As a result of an amendment to Clause 1 (1) made in Committee which has the effect of confining the Act to roads of which the local authority are the highway authority, coupled with the fact that no order can be made until confirmed by the Ministry of Transport, to whom objections can be made, it was decided not to take any further action, and the Act received the Royal Assent on July 13th.

Limitation Bill

This Government Bill, through lack of time, had to be dropped after passing the House of Lords (1st House) last session, but as amended in that House has been re-introduced in and again passed by the House of Lords in the present Session.

That part of the Bill (Clauses 21 and 22) which deals with the period of limitation in the case of actions against public authorities is of importance.

In the Bill as introduced last Session the limitation of time for the bringing of actions against public authorities under the Public Authorities Protection Act, 1893, was to be extended from six months to twelve months (Clause 21).

No objection was taken to this extension, but Clause 22 provided that where a person to whom a right of action accrues under Clause 21 is under a disability, then the action might be brought at any time before the expiration of one year from the date when the person ceases to be under a disability or dies.

It will be appreciated that this provision might have enabled an action to be brought many years—as many as 20 or more—after the right of action accrues.

The Earl of Listowel, on behalf of the London County Council, supported by Lord Ritchie on behalf of the Association, and Lord Amulree for the Association of Municipal Corporations, raised the point on Committee Stage of the Bill last Session, and as a result the Lord Chancellor, on Report, moved a compromise amendment to Clause 22, which provided in substance that in the case of disability of infancy or unsoundness of mind the action must be brought within a year of the accrual of the right, unless the plaintiff proves that the person under a disability was not at the time when the right of action accrued to him in the custody of the parent.

Licensing of Advertisements (Scotland) Bill

This Private Member's Bill was introduced by Lord Polwarth in November, 1937.

Clause 7 of the Bill purported to repeal, so far as Scotland is concerned, the Advertisements Regulation Act, 1925, which contains (Section 1 (3)) a protection against bye-laws made by a local authority in the case of advertisements exhibited on harbours, docks and canals.

Representations were made to the effect that docks should be allowed to share in the exception given in the Bill for railway companies against licensing, and Lord Polwarth in moving the Second Reading of the Bill on 30th March, said that there would be no objection to this.

The Bill was read a second time, but did not proceed further, owing to the fact that a Committee had been set up by the Government to consider the whole question of advertisements. After this Committee has reported legislation will no doubt follow.

Prevention of Fraud (Investments) Bill

This Government Bill was introduced at the end of last Session, but only for information. The Bill has been re-introduced in substantially the same form, and in December passed Standing Committee in the House of Commons.

The main object of the Bill is to regulate the carrying on of ' the business of dealing in securities," for which purpose a licence will have to be obtained from the Board of Trade except in the case of such persons as are mentioned in the proviso to Clause 1 (1) of the Bill including " exempted dealers." The object of Clause 12 is to define the class of persons who may be declared to be " exempted dealers."

It appeared that unless the Bill were amended Dock and Harbour Authorities might be held to be included under its terms with the result that before such bodies could issue Debenture Stock, Bonds and other securities for the purpose of borrowing under the authority of their Acts of Parliament they would have to obtain a licence or be registered as an exempted dealer and submit the conduct of their business to interference by the Board of Trade. Meetings were held with Board of Trade officials, and, as a result, by an amendment moved in Standing Committee "A" on the 6th December by Mr. Cross (Parliamentary Secretary to the Board of Trade), the doing of anything by or on behalf of a statutory corporation as defined in Clause 24, has been added to the excepted businesses in the proviso to Clause 1 which are excluded from the Bill.

Coast Protection Bill

This Private Member's Bill was introduced in July and made no progress last Session.

Dock and Harbour Authorities' Association—continued

The Bill was re-introduced this Session, and although fourth on the list for Friday, the 9th December, it obtained a second reading on that day, and has been assigned to Standing Committee "B."

It will be remembered that in 1929 the Government brought forward a very comprehensive measure under this title, which reached Committee stage, but owing to the numerous amendments which had been set down, made no further progress (*vide* Annual Report, 1929, pages 11 and 12).

The present Bill is based on Clause 3 of the 1929 Bill, and its purpose is to enable the Board of Trade by Order to prevent or impose restrictions as to the excavation, removal, etc., of materials on under or forming part of specified portions of the seashore, and "seashore" is defined to mean the bed and shore of the sea and of every channel creek, bay, estuary, and of every river so far up that river as the tide flows, and any cliff bank, barrier, dune, beach, flat or other land adjacent to the foreshore.

The Bill is being considered by the Association's Parliamentary Sub-Committee, especially from the point of view of ensuring that nothing in the Bill shall interfere with the statutory rights of Harbour Conservancy and Navigation Authorities to dredge in their harbours, channels or rivers.

One safeguard in the Bill which was absent from Clause 3 of the 1929 Bill is that before the Board of Trade can make an Order a local inquiry must be held and the draft of any Order proposed must be laid before Parliament and approved by a resolution of both Houses.

Finance Act, 1938, and
Rating and Valuation (Air-Raid Works) Act, 1938.
Rating and Valuation (Air-Raid Works) (Scotland) Act, 1938

Section 17 of the Finance Act provides for certain exemptions from Income Tax under Schedule "A" in respect of buildings and additions, alterations and improvements to existing buildings, used solely for affording protection from hostile attack from the air.

From a statement made by the Minister of Health (Mr. Walter E. Elliot) in the House of Commons on the 14th July, in connection with the Rating and Valuation (Air-Raid Works) Bill, it is clear that shelters, etc., may be used for the storage of air-raid equipment or for air-raid drill purposes without any risk of the relief given by the Section being withdrawn.

Under the Rating and Valuation (Air-Raid Works) Acts above referred to, the principles to be applied in connection with Income Tax relief for air-raid works under Section 17 of the Finance Act apply also for rating purposes.

Air Raid Precautions—Schemes for Dock Areas

So long ago as the 23rd December, 1937, the Home Secretary intimated that the Government had accepted the principle of a contribution towards expenditure on precautions taken by essential public utility services to ensure their continued functioning in war time, but no agreement has yet been reached on the percentage contribution which would be granted for dock schemes.

Circular No. 437, dated 16th July, informed Members of the meeting which representatives of the Port of London Authority and the Mersey Docks and Harbour Board had with Government officials on 13th June, members were asked for information as to the approximate percentage the persons employed directly by the Port Authority on a normal day bears to the total number of persons at the docks on that day, including the crews of vessels.

As a result of the information received, proposals were settled for submission to the Government as set out in Circular No. 439, dated 3rd August, and these proposals were submitted at a meeting at the Ministry of Transport on 13th October, *vide* Circular No. 443, dated 24th October, which forwarded the official note of that meeting.

The Executive Committee are giving special attention to this question, and are in close touch with the Minister upon it.

Railways Act, 1921
1938 Review of Standard Charges and Exceptional Charges

It will be recalled that at the 1937 Annual Review when the Association appeared by Counsel and made representations (Report for 1937, pages 10-11 and Appendix pages 27-30) witnesses for the Railways stated that the Companies were considering lodging applications for an increase in the statutory maxima of the charges leviable at the Railway-owned Docks.

The Committee in view of information that this course was shortly to be adopted decided that no objection, calling attention to the unsatisfactory position of the Railway Dock Undertakings, should be lodged with the Railway Rates Tribunal at the 1938 Review.

The Review was held on 17th May, and Sir Walter Monckton, K.C., in his opening speech for the Railway Companies, stated that applications had been forwarded to the Minister by the L. & N.E. and L.M. & S. Railway Companies for an increase in dock charges. These Companies, however, on the 18th November, informed the Association that they had withdrawn their applications.

The Southern Railway Company in their Bill promoted in the 1937-38 Session inserted a Clause to increase the rates, rents, tolls and charges at Southampton by 20 per cent. This Clause was amended so that the Minister of Transport may make an order revising the authorised rates and charges which the Company may levy at their Southampton Docks up to but not exceeding 20 per cent. over the maximum rates and charges previously authorised.

In their Bill of the present Session the Company propose to remove the 20 per cent. margin and thus enable the Minister to make an order increasing the maximum rates and charges to any extent.

The Company have applied to the Minister for authority to increase dock charges at Southampton on passengers and rates on merchandise by 7½ per cent., and on grain and kindred commodities and rates of rent on goods by 10 per cent.

Applications by the Railway Companies for Orders authorising increased charges at their dock undertakings are made to the Minister of Transport, and under the London, Midland and Scottish, the London and North Eastern and Southern Railway Acts of 1930, and the Great Western Railway Act of 1931, the Minister before making an Order shall cause an Inquiry to be held by the Rates Advisory Committee constituted under the Ministry of Transport Act, 1919 (or any Sub-Committee to which that Committee may have delegated its powers), or in the event of the Committee having ceased to exist by a body of persons with similar qualifications.

The Rates Advisory Committee ceased to exist on 31st December, 1937, and the Minister therefore appointed a body of persons similarly constituted to the Harbours, Docks and Piers Sub-Committee of the Rates Advisory Committee, which was the body to which these applications were submitted in the past.

On the Mininster's invitation, the Association nominated Mr. J. D. Ritchie, General Manager, Port of London Authority, who was appointed to this Committee.

Application by Railway Companies for Removal of Statutory Regulation of Charges for the Conveyance of Merchandise

The Railway Companies at a deputation to the Minister of Transport, on 23rd November, submitted the following proposals:—

(a) The existing statutory regulation of the charges for the conveyance of merchandise traffic by railway, together with the requirements attached thereto, including such matters as classification, publication and undue preference, should be repealed.

(b) The railways, exactly like other forms of transport, should be permitted to decide the charges and conditions for the conveyance of merchandise which they are required to carry.

After a further meeting on the 8th December, when the proposals were amplified, the Minister submitted the Companies' claim to the Transport Advisory Council, and asked the Council to advise him

(a) "Whether, in their opinion, the whole of the existing statutory provisions relating to the charges for the conveyance of merchandise traffic by rail should be repealed, or

(b) whether, while retaining the broad outline of the existing position, certain provisions should be repealed or modified,

(c) in either case, what, if any, safeguards would be desirable for the protection of other interests."

Broadly speaking, the proposals of the Railway Companies, if put into force, might have incalculable effects on the trade routes and the flow of traffic through the ports.

The Chairman of the Executive Committee therefore wrote to the Minister of Transport expressing the hope that he would not come to any conclusion on the matter until he had heard the Association's observations.

In his reply, the Minister pointed out that the non-railway-owned docks were represented by Sir Lionel Warner, Mersey Docks and Harbour Board, on the Transport Advisory Council, but that if the request was renewed when he was in possession of the Council's report, he would be pleased to consider it before making any decision.

In addition to Sir Lionel Warner, Mr. J. D. Ritchie has been given the right to attend the meetings of the Council and take part in its discussions in this matter.

Negotiations are proceeding with the representatives of the Railway Companies, as an outcome of which it is believed that the statutory protection against undue preference which inde-

Dock and Harbour Authorities' Association—continued

pendent dock undertakers now enjoy will be continued, though in a slightly different form, and at the same time it is hoped to set up conciliation machinery which will lead to a closer contact and co-ordination between such undertakers and the Railway Companies in all matters which affect them both.

Factories Act, 1937

The provisions of Section 22 (Hoists and Lifts) of the Act should have come into operation on 1st July, 1938.

Representatives of the Association, the Railway Companies, and the London Association of Public Wharfingers, Ltd., met Officials of the Factories Department of the Home Office on the 22nd June, and urged that owing to extensive structural and other alterations which would have to be made to comply with the terms of Section 22 to hoists and lifts in dock warehouses, the operation of the section in this respect should be postponed.

As a result of the Meeting, the Home Secretary made an Order, dated 30th June, postponing until 1st January, 1940, the coming into operation of the requirements contained in Subsections (3), (4), (5) and (7) of Section 22 of the Act as respects hoists and lifts.

Proposed Model Schedule of Charges for Seaplanes

As stated in the Report for 1937 (pages 13 and 14) the Ministry of Transport invited the Association together with the Railway Companies as dock owners to confer with the Ministry and the Air Ministry, with a view to drawing up a Model Schedule of Charges for Seaplanes entering or using the undertakings of Dock and Harbour Authorities.

A draft Schedule was submitted by the two Associations at a Meeting at the Ministry of Transport in December, 1937, for the approval of the Government, and there are points outstanding in connection with the draft upon which negotiations are still proceeding.

It is emphasised that the discussions concerning the Model Schedule have been confined to the kind of services rendered for which a charge ought to be imposed and no attempt has been or could be made to settle the amount of any charge.

Central Advisory Water Committee

This Advisory Committee, under the Chairmanship of Lord Milne, was set up by the Government with the following terms of reference:—

(a) To advise the Government Departments on questions relating to the conservation and allocation of water resources;

(b) To advise the Government Departments on any questions which may be referred by them to the Committee with respect to any matter arising in connection with the execution or any proposed amendment of the enactments relating to water; and

(c) To consider the operation of the enactments relating to water and to make to the Government Departments such representations with respect to matters of general concern arising in connection with the execution of those enactments, and with respect to further measures required, as the Committee think desirable.

The Committee informed the Association in January that they were investigating the question of the desirability or feasibility of constituting comprehensive river authorities for the control of the rivers of England and Wales, and asked for the Association's views.

Members of the Association in England and Wales were circularised, and their views were collated by a Sub-Committee and embodied in a memorandum which was submitted to the Advisory Committee in April. This memorandum is attached to the May Interim Report (Circular No. 431) as Appendix A.

As the Advisory Committee wished to discuss the Memorandum, Mr. M. Kissane, Secretary, Manchester Ship Canal Company, was asked to represent the Association at a Meeting with the Committee on 19th July.

At that meeting, on the general question whether a comprehensive river authority should be established, Mr. Kissane made it quite clear that the Association would deprecate the encroachments of new jurisdictions in tidal waters controlled by a dock and harbour authority.

Great Yarmouth Port & Haven Commissioners v. F. T. Everard & Sons, Ltd.

In this case, which is of considerable interest to Dock and Harbour Authorities, the contention of the defendants, who own motor cargo vessels and sailing vessels, was that if they tow their own sailing vessels with their motor vessels they were only liable to pay dues as upon cargo-carrying vessels and were not liable for towage dues.

The Court of Appeal upheld the decision of the County Court Judge, and decided that the defendants' cargo-carrying vessels were not vessels "used for the purpose of towing" (which meant primarily used for that purpose), and that therefore they were not entitled to the various immunities which were reserved for tugs.

Further, that not being vessels primarily used for the purpose of towing, they could not claim to commute their liabilities by an annual payment.

Import Duties Act, 1932—Finance Act, 1935
Value of Goods for Duty

The Report for 1937, pages 21 and 22, states that H.M. Customs were proposing a flat rate addition of 3s. per ton to the value of goods for duty purposes at Bristol Channel ports.

In spite of protests and meetings with H.M. Customs, a notice to traders at Bristol Channel Ports (Bristol—including Avonmouth—Cardiff, Swansea, Llanelly, Newport and Gloucester) was issued on 14th July to the effect that the proposed 3s. flat rate would take effect from 2nd August.

It has been arranged that a further attempt shall be made in conjunction with the other bodies who were concerned in negotiating the agreement of May, 1932, to induce the Customs to alter their decision.

International Labour Office—40-Hour Week

The 1938 International Labour Conference adopted a resolution asking the Governing Body to summon one or more technical Tripartite meetings to study reduction of hours of work in transport, and requesting the Governing Body to place that question on the Agenda of the International Labour Conference as soon as the Tripartite meetings had reported.

The Governing Body considered the matter at its meeting in London in October.

In the course of the discussion, a proposal was made by the Workers' Group that the suggested Tripartite meetings should deal not only with rail transport but also with inland water transport, air transport, handling of goods at docks, and with road transport workers.

The Governing Body decided to convene a Tripartite Technical meeting on Reduction of Hours of Work in Rail Transport only, the meeting to be held on 20th March, 1939.

Uniform System of Maritime Buoyage

The Agreement for a uniform system of buoyage settled by a preparatory Committee in London in 1933, was submitted for signature by the States whose Governments had been invited to the Lisbon Conference in 1930.

It is stated in the Report of the Communications and Transit Committee of the League of Nations, dated 16th August, 1938, that up to May, 1937, fourteen signatures had been received, and since then two secessions and one ratification had been deposited. There have been some further ratifications recently, but the British Government has not yet signed the agreement.

Sea Pollution (Oil)

The Board of Trade enquired as to the practice of Port Authorities in connection with the disposal of the sludge removed from the tanks of ships in which oil has been carried, and this information was collected and forwarded to the Board on 26th January, 1938.

In reply to a question on the point in the House of Commons on 15th March, Mr. Stanley (President of the Board of Trade) made the following statement:—

"Separator barges are available at several of the important commercial harbours of this country for the purpose of receiving oily water from vessels, and the recovered oil is either consumed in the ordinary way or is burned under boilers at shore works. There is no uniform method of disposing of the sludge. If it is incombustible it is sometimes dumped on land as ordinary refuse, and sometimes taken out to sea and dumped at varying distances from land outside territorial waters. So long as the deposits are not made within territorial waters in contravention of the Oil in Navigable Waters Act, 1922, there is no power to take action; but I am not aware that any pollution of our coasts is caused by the dumping of the sludge."

Publication Received.

There has come to hand from the Department of Scientific and Industrial Research a Summary of the Annual Report for the year 1937-8 (published by H.M. Stationery Office; Price: 3s. net, Cmd No. 5927). It contains a survey of the various fields of investigation within the immediate purview of the Department, some of which, such as Food Storage and Transport and the protection of grain from insectile depredation, are matters of importance to port authorities. It is of interest to note that the Food Investigation Board is to be invited "to review the whole field of research into the processing of foodstuffs and to submit proposals for embracing under their scientific supervision such work in this field as they may consider to be desirable in the national interest."

Maritime Services Board of New South Wales

Excerpts from the Third Report for the Year ended 30th June, 1938

Port of Sydney

Financial.—The accounts for the year ended 30th June, 1938, show a net surplus of £299,495 19s. 1d., which is an improvement of £44,068 15s. 11d., as compared with the previous year, when the surplus was £255,427 3s. 2d.

The Reserve Account now stands in credit to the extent of £744,439 16s. 3d. Attention is, however, directed to the fact that this figure was arrived at without provision being made for the depreciation of the Board's wasting assets amounting to approximately £5,000,000 at the Port of Sydney.

Income.—The net income earned during the year, namely, £1,186,279 3s. 7d., exceeded the figures of the previous record year, that ended 30th June, 1929, by £82,681 5s. 4d., or 7 per cent. The improvement on the figures for the year ended 30th June, 1937, was £92,587 17s. 6d., or 8.5 per cent.

Oversea Trade.—The principal source of increase was in the inward oversea trade, the wharfage rates on goods imported from oversea amounting to £368,779 15s. 3d., as compared with £309,572 15s. 11d. for the preceding year, an improvement of £59,206 19s. 4d., or 19 per cent. Owing to the decrease in the quantity of goods shipped abroad during the year the revenue from outward oversea wharfage rates declined from £75,155 3s. 8d. to £69,756 18s. 6d.

Inter-State Trade.—Notwithstanding that the volume of inter-state trade, both inward and outward, continued to expand during the year, the revenue from inward wharfage, which amounted to £195,897 19s. 1d., was £2797 1s. 8d. below the record figures of the previous year. A contributing factor to this reduction in revenue was the increase in the importation of certain classes of goods which are scheduled at a lower wharfage rate.

The return from wharfage on exports to other States increased from £47,078 12s. 10d. to £55,198 13s. 0d.

Intra-State Trade.—In the intra-state trade the wharfage on imports amounted to £98,100 17s. 4d., which was a record, and exceeded the previous year's figure of £87,090 12s. 1d. by £11,010 5s. 3d., whilst the outward trade returned £21,033 6s. 9d., as compared with £19,483 11s. 8d.

Working expenses increased by £49,335 19s. 10d., most of which was due to greater expenditure on maintenance of property and plant and further and complete restoration to officers of the reduction which had been made under the Salaries Reduction Act.

Trade and Shipping

Shipping.—The volume of shipping which entered the Port of Sydney during the year again constituted a record at 20,326,104 tons (gross) and exceeded the figure of the previous year (record) by 1,174,710. The number of vessels making up the aggregate tonnage was 7,755, as compared with 7,295 during the previous year, an increase of 460.

Compared with the year 1928-29, the increase in the volume of shipping during 1937-38 was 4,697,499 tons, or 30 per cent.

Trade.—The total import and export trade of the Port during the financial year, 7,981,138 tons, was the greatest in its history, and surpassed the record figure of the previous year by 499,436 tons. The volume of imports amounted to 5,472,988 tons, as compared with 4,854,473 tons for the previous year, an increase of 618,515, or 12 per cent.; the exports, however, declined by 119,079 tons (4 per cent.), from 2,627,229 tons to 2,508,150 tons.

Works and Improvements

" Capital " Work.—Expenditure from Loan Votes during the year amounted to £27,754 5s. 2d., as compared with £53,068 4s. 4d. during the previous twelve months, the principal works being as follow:—

Nos. 4-5 Berths, Walsh Bay.—A commencement was made on the work of re-modelling Nos. 4-5 berths, Walsh Bay, which will involve the lowering of the raised portion of the upper floor; the raising of the wharf deck of No. 4 to bring it up to the same level as No. 5; the widening of the lower shed by 20-ft.; the provision of a platform, together with five new steel gantries on the western side of the upper floor; and relegating the elevators, deadhouses, offices and sanitary accommodation to exterior or end positions. The alterations, when completed, will enable more effective use to be made of the upper and lower floors, both of which will have an uninterrupted cargo space of 612-ft. by 80-ft. from end to end; will permit of vessels being berthed and worked on either side of the jetty; and will, with the provision of adequate lifting appliances, facilitate the handling of cargo.

Nos. 28-29 Berths, Darling Harbour.—In order to permit of the working of these berths as one property, a connecting cross wharf was constructed covering an area of 70-ft. by 31-ft. 7-in. (mean). In addition, the weighbridge was enlarged, and a more direct entrance was provided to the upper floor of the shed.

No. 35 Berth, Darling Harbour.—An open shed, approximately 150-ft. by 50-ft., with galvanised iron roof, was erected on the jetty to provide additional covered space as a protection for cargo. Previously, the only covered space was that on the shore portion of the premises.

Nos. 37-38 Berths, Darling Harbour.—A cross wharf, 331 square in extent, was erected between these jetties, and a commencement was made on the work of widening No. 38 berth by 20-ft. for its entire length of 331-ft.

Port of Newcastle

Newcastle Advisory Committee.—Alteration in Personnel.—Mr. Robert Innes, who was appointed as a member of the Committee on the 26th February, 1936, resigned from that position in May, 1938, and Mr. Alan Dalziel was appointed in his place.

Future Development of the Port.—In the previous annual report reference was made to an outline scheme prepared for the future development of the port, which had been submitted for comment to the Department of Works and Local Government, the Department of Railways, the Newcastle City Council, and the Newcastle Chamber of Commerce. Favourable replies were received from all these bodies with the exception of the Department of Railways, which appointed a Special Committee of Departmental Officers to closely examine the proposal. Pending an official reply from this Department, further consideration by the Board has been deferred.

Deepening of the Harbour.—Good progress has been made by the Department of Works and Local Government in deepening the rock bar at the entrance and in deepening and widening the channel leading to the steel works.

Lee Wharf Extension.—The work of extending the high-level wharf by 100-ft. and the construction of a new low-level wharf, 460-ft. in length, has been greatly delayed through difficulties in obtaining suitable material. It is hoped that the high-level extension may shortly be available for use, but a considerable amount of work is still required to complete the low-level section.

The Report is signed by G. D. Williams (President); W. O'Connor (Vice-President); G. H. Faulks, G. C. Boehme, and D. J. Mackay Sim (Commissioners); and S. C. Barnes (Secretary).

Progress at the Port of Rotterdam

Burgomaster's Review

At a recent meeting of the Town Council of Rotterdam, the Burgomaster, Mr. G. J. Oud, referred to the results achieved by the port. Since the year 1935, he said, the net tonnage of ships arriving in the port has shown an increase; in 1936 it totalled 23.1 million tons, in 1937—26.3, and in 1938—27.6. At the same time the number of ships had increased.

The goods traffic remained almost stationary—42.35 million tons in 1937 and 42.3 million tons in 1938. Although the reduction in coal exports amounted to about 2,000,000 tons in 1938, this decrease has been counterbalanced by increases in other classes of traffic.

Special mention was made of the highly efficient quay equipment of private firms, and it was emphasised that every care would be taken to ensure that equipment owned by the municipality would enjoy the same high standard. Municipal warehouses and cranes enjoyed a year of moderate prosperity, and by the end of the year the employment of municipal cranes had reached the peak level of the year 1929. The former installation of the Royal Mail Lines in the Ysselhaven, now managed by the municipality, had greatly contributed to the satisfactory results.

At Pernis, construction of a second harbour had begun. It was hoped that the harbour would be completed this year.

Finally, the past year had shown a welcome increase in the amount of work performed by the port labourers, as registered by the " Scheepvaart Vereeniging Zuid," a voluntary organisation, which provided the necessary labour in the docks.

The Port of Plymouth.

Messrs. Cattedown Wharves, Ltd., call attention to an error in the article on The Port of Plymouth on page 96 of the February issue, in which it is stated that the Corporation Wharf does " a considerable coastwise trade in general cargo, import of coal and petroleum, and export of china clay, fertilisers, etc." They state that the only commodity discharged at the Corporation Wharf is coal for the City's electricity undertaking, in accordance with a clause in the Plymouth Corporation Bill of 1898.